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TELEPHONES AND THUNDER-STORMS.

Our esteemed contemporary, the New York *Times*, while pleased to learn that we do not consider a telephone to be a particularly dangerous thing during thunder-storms, confesses that its editor feels somewhat nervous when called upon to use his telephone on such occasions. The editor knows that accidents have been reported in which telephones were destroyed by lightning, with rather terrifying consequences to the persons using them, and he has in mind the possibility of a similar occurrence to himself. If we knew how to allay this anxiety, we should hasten to do so. We must confess that telephones have been injured by lightning, but so have iron bedsteads; yet we doubt whether the *Times* would advise all who occupy these useful articles of furniture to abandon them whenever a thunder-storm occurs. Perhaps we may best describe the situation by comparing it to the daily ride to and from the office. Railway accidents are not unknown, yet how many of us hesitate before stepping aboard the train. Any one who feels nervous about using a telephone during a thunder-storm is free to do so, but on the same principle, he should just as carefully avoid all the thousand and one daily acts which involve a more or loss remote danger.

Unfortunately for the engineer, lightning is a most capricious and uncontrollable phenomenon. We have devised lightning protective apparatus on every principle which seemed at all to promise success, and yet we can not guarantee absolute protection. Lightning is not satisfied to destroy by discharging directly through the object struck; it at times causes what are known as induced flashes—secondary currents produced by the lightning discharge itself in objects through which the true discharge does not pass. The problem of lightning protection may be compared to what would be presented to the artillery engineer if he were obliged to protect his men from the report of the exploding shell, as well as from the shell itself. However, the engineer does the best he can; he adds as much protection to his electric conductors and telephone systems as he knows how; more he can not do. We believe, however, that if the *Times* will count up the number of telephones reported as destroyed by lightning during a storm in any section, and will then compare this with the total number of telephones in use for the same section, it will see how few are the accidents which do happen, and how slight the probability of any one's being injured in this way.

THE ELECTRICAL DRIVING OF SHOPS.

Viewed in one way, the electric motor has made considerable progress in shop driving. According to some figures given recently by Mr. Sidney B. Paine, at a meeting of the New England Cotton Manufacturers' Association, it is estimated that there are 175 textile mills in this country which are using 140,000 electric horse-power in their mills—a good showing for ten years' development. On the other hand, the census for 1900 shows that 1,165,045 horse-power was being used in all cotton, woolen, worsted and silk mills in the United States. Allowing an increase of about twenty-five per cent, Mr. Paine finds that only about ten per cent of the power used in these mills is applied electrically. Comparing this record with what has been done in the street railway field, it is evident that there must be some reason for the poorer showing of the mill motor.

Probably the main reason for this comparative lack of develop-

ment is the fact that driving a mill by means of ropes and shafts is more satisfactory to the operators than were the old horse-cars to the public. Nevertheless, we do not believe that this is the only explanation. There are many mill owners who do not realize the benefits to be derived by changing over to the electric drive. They, no doubt, think that it is merely a question of the relative cost of power, and they can not see how they can gain by displacing the present driving system for one which is rather expensive. While the electric system may, in some cases, reduce the cost of power, this is not its most important advantage. In fact, compared with the gains made in other ways, the cost of power is of small moment. The electric drive is beneficial because of its steadiness and because of its flexibility. Since the drive is steadier than that given by the old system, a better product is produced, and a higher speed, and consequently a larger output, results. Adding to these great advantages that of being able to arrange your machinery just where and how you wish, without regard to the disposition of other machines, it is evident that a slight difference in the cost of power one way or the other should have but little influence when comparing the new system with the old.

THE OSCILLOGRAPH.

Surely the oscillograph may be considered to be one of the most interesting instruments devised to study electrical apparatus. It is to the engineer what the kinetoscope or the phonograph is to the public, for it not only shows him what is going on in his electrical circuits, but enables him to obtain a record of what happened during an exceedingly short time. Most indicating electrical instruments are developments of some form of galvanometer, and this generalization applies to the oscillograph, which is nothing more than a galvanometer designed to have an exceedingly high period of vibration, and arranged so that the movable part will follow exactly the variations in magnetic force set up by the current to be examined.

The oscillograph, however, is used, not merely as an ordinary galvanometer, to determine a particular value of the current, it also shows how this current varies. In other words, it draws a curve corresponding to the changes in the value of the current as these take place.

There are several types of oscillograph. One is a development of the moving-needle galvanometer; another an elaboration of the D'Arsonval or moving-coil galvanometer. There are still other types, such, for example, as Professor H. J. Ryan's cathode-ray instrument and that described recently by Mr. Rudolf Goldschmidt, which was referred to in the ELECTRICAL REVIEW for May 13.

A noteworthy example of the second or movable-coil class was described by Mr. Lewis T. Robinson at a recent meeting of the American Institute of Electrical Engineers. A full abstract of Mr. Robinson's paper appears on another page of this issue. The instrument described has been constructed with a particular view to its practical use. It is not a laboratory instrument in the sense that it can not be used outside of a well-equipped laboratory where all conditions are favorable. But it must not be assumed that, since the instrument has been devised for practical work, it has lost anything in accuracy or sensitiveness. The frequency of the period of the moving part is 5,000 vibrations per second, which is evidently high enough for all practical purposes. It could be made higher if desired. While this high frequency enables the instrument to move as quickly as the variations which it is to follow take place, this characteristic is not sufficient for an accurate instrument. The motion of the vibrating part must be damped, so that it does not superpose its own natural period upon the curve to be traced. In other words, the instrument must be designed to have a high natural period, and it must then be damped so that its motion just ceases to be harmonic. When these conditions are fulfilled, the instrument follows accurately every change in the actuating force.

Another valuable feature of this particular instrument is the employment of three independent elements, each being a perfect oscillograph. This arrangement enables the variations in three currents to be followed simultaneously. Of course, other elements could be added were it desirable. Another feature is the arrangement which enables the experimenter to examine visually the wave forms of the currents. He can, while changing the conditions in his circuits, watch the effect produced by any alteration. When he has obtained the desired condition, he may then take a record. This record may be either a curve representing the average conditions of a comparatively short period during which a number of complete reversals have taken place, or it may be the record of a single occurrence. Each of these records has its value: the first shows the general operating conditions; the latter must be used when the event to be recorded is not recurring. When a trace is made of a single wave it should be remembered that the record is but a single reading and may not represent the average conditions. It merely shows what was going on when the record was taken.

Although the oscillograph has been devised for studying electrical machinery, it may be used for recording other events. For example, when attached to a telephone transmitter, speech may be recorded just as is done by the phonograph. Its use in this manner should be of value to those who, in studying the sound vibrations set up by the human voice, have been obliged to reproduce enlarged records from the phonograph.

During the discussion following the reading of Mr. Robinson's paper, an interesting suggestion was made by Mr. Caryl D. Haskins. The idea was that some scientific romancer might, in a story, substitute for our written language records of natural word vibrations, such as are recorded by the phonograph or the oscillograph. At first thought this seems to be beyond the possibilities, but if we could do it, what a convenience it would be. Letters could be dictated into an oscillograph and in a few minutes mailed to their destinations. Every telephone could be made to record conversations or messages. Of course, many difficulties might be suggested, but who will say they are insurmountable.

THE AMERICAN RAILWAY APPLIANCE EXHIBITION.

The exhibition of American railway appliances at Washington during the recent International Railway Congress attracted much attention from the foreign engineers, but it seems that it was even more appreciated by American railway men, as it offered them an unusual opportunity to examine all the latest and best apparatus. For these men it was particularly satisfactory because of its completeness. Railway exhibits at large expositions are usually made with the idea of attracting public attention. The one at Washington was an exhibit designed for railway men. The efforts of the exhibitors were not wasted, and will undoubtedly bear excellent fruit.

Speaking of this phase of the exhibit, our esteemed contemporary, *Engineering News,* makes the suggestion that a similar exhibit be made every few years for the benefit of the operating railway engineers. This exhibit, it says, might be offered in connection with the meetings of a number of bodies interested in railway work. If this were done and the plans made long enough ahead, there is no doubt that the exhibit would draw to it a number of other technical societies. In fact, it could be counted upon to attract nearly all the important engineering organizations. There is none of these but that, in some part of its work, is brought into contact with railway problems. The suggestion is well worthy of careful consideration.

FIXATION OF NITROGEN.

The importance of developing some method of fixing the nitrogen of the air so as to make it available for plant food has been dwelt upon again and again. Many attempts have been made, some of them promising final success. Heretofore the problem has been attacked in three ways: first, by taking advantage of the oxidation of the nitrogen of the air brought about by the electric arc; second, by causing chemical reaction to take place between the nitrogen of the air and calcium carbide; third, by preparing a culture of bacteria which causes the formation of nodules on the roots of leguminous plants. This culture is applied to soil which is planted in beans, clover or some other similar crop, and the ground enriched in this way, since the bacteria have the ability to fix atmospheric nitrogen.

There is now a fourth method proposed, which is briefly referred to in the *Electrical Review* (London), May 5. The process is a purely chemical one, and was invented by Professor Wilhelm Eschweiler, of the Technical High School at Hanover, and Dr. H. C. Woltereck, of London. It consists mainly in passing a stream of air mixed with steam over a mass of peat in a state of slow combustion. The effect is to cause some of the nitrogen in the air and some of that contained in the peat to become fixed by means of the hydrogen obtained from the decomposition of the steam. Ammonia is thus formed, which is then taken up by the sulphuric acid so as to form the sulphate. It is said that over five tons of sulphate of ammonia are obtained from 100 tons of peat, and that the cost of production is less than half the market price of sulphate of ammonia. With these four methods available, it should not be long before we are able to supply the threatened deficiency of nitrogenous fertilizers.

It is interesting to compare the different ways which have been devised for causing nitrogen, usually so inert, to become "fixed," that is, to form a chemical compound with some other element. The first referred to is purely electrical; the second, a chemical reaction using, however, a product of the electric furnace. The one just announced is purely chemical, while one is biological.

HIGH-SPEED RAILWAYS.

The interesting paper read by Dr. Friedrich Schulz before the International Railway Congress, at Washington, in which he gives conclusions drawn from the Berlin-Zossen high-speed tests, shows the confidence which the author feels in the practicability of very high-speed operation of electric cars. Dr. Schulz believes that the present methods of track construction are satisfactory, and that, with slight modification, our present cars can be operated at speeds of over 100 miles an hour safely, provided a clear way can be assured.

The greatest danger seems to be in the failure of the signaling system, for, during foggy weather, the track signals were not visible soon enough to be effective. This trouble was somewhat overcome by an electrically operated signal carried on the car itself, which operated satisfactorily throughout the tests. But where speeds of from 100 to 120 miles an hour are sought, it would seem to be only proper to provide a duplicate signaling system to ensure safe operation during bad weather. A high-speed road, to be successful, must be able to maintain its schedule at all times, and although the passengers on the test car may have felt safe during the remarkable experimental runs, as they knew there was no other train on the track, greater precautions seem necessary for a road designed for actual service. A possible solution of the problem would be the cutting of high-speed roads into long blocks—for example, a block from New York to Philadelphia, a second from Philadelphia to Baltimore, a third from Baltimore to Washington, etc. The longest section here is but little over ninety miles, and, with an hourly service, each block would be clear before a train left. Of course, such a road would have to be elevated over other roads or have them carried over it. Grade crossings of any kind would not be permissible.

One point brought out by Dr. Schulz in his paper is the rapid rate at which the air friction increases. He thinks that this factor may lead to the adoption of a service maintained by a few trains, rather than by a number of single cars. With such service the block problem would be simplified.

There is no doubt that a safe high-speed road connecting the largest cities would get the greater part of the through passenger traffic, but whether we are quite ready for it is not so sure. The large railroads of this country are at the present time carrying out, or planning to carry out, some very remarkable and expensive work, and they will feel some hesitation toward undertaking what will be something of an experiment. On the other hand, if they delay too long they may find that the electric roads have forestalled them, and that their through traffic is being reduced as seriously as their short-haul traffic has been cut down by the suburban electric roads. We wonder if the railway presidents do not often wish that the electric motor had never been invented.

American Society of Mechanical Engineers.

The fifty-first meeting of the American Society of Mechanical Engineers will be held at Scranton, Pa., from June 6 to June 9, 1905. The professional sessions will be held at the Young Men's Christian Association Building, corner Washington avenue and Mulberry street, on Tuesday evening, June 6; Wednesday morning and evening, June 7, and Thursday morning, June 8. The headquarters will be on the second floor of the Hotel Jermyn, corner Wyoming avenue and Spruce street. The headquarters will be opened Tuesday morning, June 6, and remain open throughout the meeting.

At the opening session on Tuesday evening the society will be welcomed by Mr. William F. Mattes, chairman of the local committee. Mr. John R. Freeman, president of the society, will respond. Professional papers will be presented at this session as follows: "The Transfer of Heat at High Temperatures," Frank C. Wagner; "Standard Unit of Refrigeration," F. E. Matthews; "Formation of Anchor Ice and Precise Temperature Measurements," Howard T. Barnes; "Some Types of Centrifugal Pumps," William O. Webber.

The second session, to be held on Wednesday morning, will be the business session for the reports of tellers and committees, and general business. Any new business outside of the professional papers will be presented at this time. After the executive business has been disposed of, professional papers will be taken up as follows: "Microstructure and Frictional Characteristics in Bearing Metals," Melvin Price; "Cast Iron, Crushing Loads and Microstructure," William J. Keep; "Smoke and Its Abatement," Charles A. Benjamin.

Wednesday afternoon is left open for visits to points of interest in and about Scranton. During the afternoon a reception and tea will be tendered to the visiting ladies by Mrs. J. Benjamin Dimmick.

The third session will be held on Wednesday evening at 8.30 o'clock, when the following papers will be presented: "Can a Steam Turbine Be Started in an Emergency Quicker than a Reciprocating Engine of the Same Power," A. S. Mann; "Note on Efficiency of Steam-Generating Apparatus," A. Bement; "Performance of a Superheater," A. Bement; "Counterweights for Large Engines," D. S. Jacobus; "Steam-Actuated Valve Gear," William H. Collier.

The closing session will be held Thursday morning, and professional papers will be presented as follows: "Note on Heads of Machine Screws," H. G. Reist; "Belt Creep," W. W. Bird; "Function of Laboratory Courses in the Curriculum of Engineering Schools," Charles E. Lucke; "Continuous Measuring and Mixing Machines," E. N. Trump; "Epochs in Marine Engineering," George W. Melville.

Arrangements have been made to entertain the visiting ladies on Thursday morning by a drive around lake Scranton, and an excursion on Thursday afternoon is being arranged for members and guests. If possible, a special train will be secured for a visit to the new car-shops and power station of the Delaware, Lackawanna & Western Railroad in the Keyser valley. The details of this excursion are not yet complete, but a printed circular will be distributed at the meeting, giving full information regarding it.

On Thursday evening at nine o'clock a reception will be tendered the society by the local members, assisted by the Scranton Engineers' Club, the Board of Trade, and the citizens of Scranton. The reception will be held at the Scranton Bicycle Club, 545 Washington avenue.

An excursion to Wilkesbarre over the Laurel line is being planned for Friday, June 9. The trip may possibly be extended to Hazleton. Full information regarding this trip will be contained in a circular to be distributed at the meeting.

Copper in Honduras.

William E. Alger, consul, Tegucigalpa, Honduras, March 29, 1905, reports a rich discovery of copper recently made in the department of Yoro, in Honduras. Those who have examined it state that the amount of ore is very large and very rich, running from fifteen to sixty per cent copper. The discoverers have located eight well-defined veins, which can be traced for miles on the surface, two of these being twelve feet wide, one ten feet, and one fourteen feet. It is calculated that the entire body will average fifty per cent copper. The consul states that taking into consideration the fact that the properties are surrounded by forests of oak and pine, a coal deposit within twenty miles, abundant water power sufficient for any machinery needed for reduction, etc., and that it is comparatively close to transportation—forty miles from the Ulua river, which is connected by canals with the bay at Puerto Cortes, from which point there is daily communication with the United States—it would appear to be a proposition worthy of the attention of American capitalists.

TWENTY-EIGHTH CONVENTION NATIONAL ELECTRIC LIGHT ASSOCIATION.

PROGRAMME DENVER-COLORADO SPRINGS, JUNE 6-11, 1905.

TUESDAY, JUNE 6.

First session, 10 A. M., convention hall, Brown Palace Hotel—Address of welcome, the mayor of Denver; president's address, Ernest H. Davis, Williamsport, Pa.

Report, "Progress," T. Commerford Martin, New York.

"The Paramount Importance of Choosing Standard in Preference to Special Machinery," David Hall, Cincinnati, Ohio.

"Insulation Testing—Apparatus and Methods," C. E. Skinner, Pittsburg, Pa.

Second session, 2 P. M.

"Automatic Synchronizing of Generators and Rotaries for Lighting and Power Sytems," Paul MacGahan, Pittsburg, Pa.

"Notes on Rotary Converters and Motor-Generators for Lighting and Power Systems," Louis E. Bogen, Cincinnati, Ohio.

"The Organization of Working Forces in Large Power-Houses," W. P. Hancock, Boston, Mass.

"Report, Committee on Steam Turbines," W. C. L. Eglin, chairman, Philadelphia, Pa.

"Operating Features of the Curtis Steam Turbine," A. H. Kruesi, Schenectady, N. Y.

WEDNESDAY, JUNE 7.

Third session, 10 A. M.

"Series Alternating-Current Motors for Industrial Work," Clarence Renshaw, Pittsburg Pa.

"A New Type of Single-Phase Motors for Elevator Work," S. Percy Cole, St. Louis, Mo.

"Long-Distance High-Tension Transmission in California," John A. Britton, San Francisco, Cal.

"Report, Present Methods of Protection from Lightning and Other Static Disturbances," Alex Dow, and Robert S. Stewart, Detroit, Mich.

"The Nernst Lamp—Its Present Performance and Commercial Status," E. R. Roberts, Pittsburg, Pa.

"The Choice of an Insulated Cable," Wallace S. Clark, Schenectady, N. Y.

Fourth session, 8 P. M.

"Some Investigations of Induction Losses," E. P. Dillon, Colorado Springs, Col.

"Mercury Arc Rectifiers," P. D. Wagoner, Schenectady, N. Y.

"Report, Advertising Methods," Percy Ingalls, Newark, N. J.

"Report, Sign and Decorative Lighting," La Rue Vredenburgh, Boston, Mass.

"Free Signs and Flat Rates," G. W. Lee, Newark, N. J.

THURSDAY, JUNE 8.

Fifth session, 10 A. M.

"Report, Progress of Electric Heating," James I. Ayer, Boston, Mass.

"Report, Purchased Electric Power in Factories," E. W. Lloyd, Chicago, Ill.

"Report, Committee on District Steam Heating," W. H. Blood, Jr., chairman, Seattle, Wash.

"Wrinkles," H. C. Abell, editor, New York city.

Sixth session, 2 P. M.

"Report, Committee on Relations with Kindred Organizations," James I. Ayer, chairman, Boston, Mass.

Executive session.

"Report, Committee on Rates and Costs," Charles L. Edgar, chairman, Boston, Mass.

"Report, Municipal Ownership," Arthur Williams, New York, N. Y.

"Question Box," Homer E. Niesz, editor, Chicago, Ill.

Seventh session, 3 P. M.

Executive session.

"Report of Secretary and Treasurer."

"Report of Executive Committee."

"Report of Committee on Relations between Manufacturers and Central Station Companies," Henry L. Doherty, chairman, New York.

Dr. Louis Bell will read a paper on the "Tantalum Lamp."

"Report of Committee on Standard Rules for Electrical Construction and Operation," Charles L. Edgar, chairman.

Election of officers.

For the accommodation of New England delegates arrangements have been completed to run a special car from Boston to Denver, leaving the Terminal station, Boston, on the Federal express at 7.45 P. M., Friday, June 2, which car will be attached to the special convention train from New York to Denver, leaving New York city June 3, at 10.25 A. M., arriving at Chicago 8.25 A. M., June 4, and arriving at Denver 2.30 P. M., Monday, June 5.

BOOK REVIEW.

"Gas-Engines and Producer-Gas Plants." R. E. Mathot. Translated from the original French manuscript by Waldemar B. Kaempffert, with a preface by Dugald Clerk. New York. The Norman W. Henley Publishing Company. Cloth. 314 pages. 6 by 9 inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $2.50.

To the operators of gas power plants of very small capacity this purely discursive treatise of 300 pages will prove beneficial. The subject matter shows wide experience and good judgment on the part of the author in the discussion of gas engine troubles and remedies; yet, there is an unfortunate absence of much of the fundamental data which are necessary to a thorough understanding of gas engine practice. And, as a whole, the book is somewhat wearisome on account of the profusion of axiomatic demonstration. Handbooks for the operating engineer and for the consulting engineer should be separate and distinct in scope and treatment. They are utterly incompatible in a well planned and readable work suitable for any business man. The elementary nature of the one adds unessential verbosity to the other, resulting in a less forceful presentation of either phase of the subject. Mr. Mathot can scarcely be accused of undue technicality in this work, rather the reverse; and one can not help but be impressed by the fact that the reader is too frequently left in the dark with the advice that in the assumed dilemma the services of an expert should be retained, this occurring in one instance on three successive pages. On the other hand, much space is devoted to details of operation which would seem more appropriate in an elementary treatise of mechanics, particularly when the matter discussed can not fail to be inapplicable to some types of apparatus. A conspicuous fault of the work is the general paucity of basic data where such are essential. Thus, the discussion of cost in chapter i is by no means conclusive or convincing. The only practical results from gas plants are given in the closing chapter where a number of tests are quoted. In no case is mention made of the duration of the test, without which all producer as well as boiler data are wellnigh valueless. Similarly, a test on street gas includes no statement of calorific value. The results presented, if we take them without question, are, however, excellent. A pressure gas plant shows a net duty of one pound per brake horse-power-hour, a sixty-horse-power suction plant 0.86 pound per brake horse-power-hour, and a 200-horse-power suction plant 0.72 to 0.93 pound per brake horse-power-hour, all at good load. These, however, are test conditions; no results of operation over long periods are given. The author states that a lignite producer is capable of giving a duty of about 3.3 pounds per horse-power-hour, the lignite containing 9,424 British thermal units per pound. Similarly, a wood producer of the Riché type is able to give a horse-power-hour on 2.2 pounds of wood, either sawdust or waste. The propagation of the term explosion motor instead of combustion motor is, in the reviewer's opinion, unfortunate and detrimental to the gas engine industry. It creates in the mind of the operator a false impression of personal hazard. Combustion, to be sure, is rapid, but it is in no manner akin to a detonating explosion in the usual sense. Mr. Mathot very properly calls attention to the necessities of avoiding interior projections in the combustion spaces, tending to cause backfiring, also to the superiority of slotted overforged cranks. One can not help being amused in his characterization of the vertical engine as "of the steam-hammer type." The simple and effective expedient of muffling the exhaust by water spray has evidently not come within the author's observation; nor have splash lubrication and the use of power oil pumps. The overheating of cylinders due to stoppage of circulating water piping can readily be detected by tapping in at the highest point in the circulating system a small riser. This not only indicates when steam is being formed in the jackets, but also acts as an overflow in case the outflow piping becomes stopped. In either case it acts as an efficient tell-tale. In the author's discussion of the advantages of high compression one would get the impression that there is no increase in economy from its use, and that serious trouble has usually arisen when attempting to increase compression. Probably this is not what the author intended to convey. Primarily the engine must be designed strong enough to withstand the pressures ensuing from combustion, sometimes as high as 500 pounds per square inch. The compression can then be raised to as high a point as permissible with the gas on which the engine is to be operated. With coal gas it might be 120 pounds per square inch maximum, with water gas much less, with producer gas it could readily be greater without danger of spontaneous combustion. It can hardly be termed as a distinctive feature of the suction type producer, that the fire can be cleaned while the engine is operating. The author does not appear to recognize the fact that an ordinary water seal type pressure producer is much more convenient to clean during operation than the suction type. The best results obtained by him in pressure producers have indicated a consumption of one to one and one-fourth pounds of anthracite per horse-power-hour, while he has obtained with suction generators, by using similar fuels, a duty of 0.9 pound per horse-power-hour. This ratio, it is true, may hold good on producers of very small capacity, in which field the suction type is preeminent. However, it is extremely questionable whether the pressure producer will be outstripped in the larger sizes. The discussion of details of the various suction types in the latter part of the book is very complete and instructive, also the description of the construction and operation of the author's continuous explosion recorder, which could be used to good advantage by all gas engine manufacturers or engineers having to conduct tests. Finally, in calling attention in the above to some of the points which particularly impressed the reviewer in reading over this book, it is to be hoped that he has not given an entirely derogatory impression of Mr. Mathot's work. It will be of value to that class of readers which desires detailed instruction on the care of gas plants and the location and remedy of difficulties which will arise. It is primarily a work for the operator, not the engineer.

LETTERS TO THE EDITOR.

Carborundum for Meter Bearings.

To the Editor of the Electrical Review:

I have read the reports of President Lieb's address before the members of the American Institute of Electrical Engineers on the subject of "Electric Meters," and the tendency of such meters to run slow on account of the wear to the bearings. He also stated several articles which had been tried to remedy the trouble, but all were either too high in price to be practical, or else were not satisfactory. Now these matters are entirely out of my line of business, but as I read the article the idea occurred to me that "carborundum" might be used to advantage, hence this suggestion.

M. Van Every.

Buffalo, May 13.

The Proposed Alliance of the Massachusetts Institute of Technology with Harvard.

To the Editor of the Electrical Review:

There is such widespread misunderstanding of the attitude of the faculty and former students of the Massachusetts Institute of Technology toward the proposed alliance with Harvard, that the public should be definitely informed, in as few words as possible, of the real grounds of the opposition of at least ninety per cent of the men of these two bodies. College loyalty and sentiment, very properly, play a part in determining their attitude toward the suggested partnership, but it is a very minor one; the chief grounds of opposition are to be found in that common-sense, clear thinking and business caution which the Institute training does so much to foster. The theoretical advantages of such an alliance are indeed attractive; but when reduced to the practical details of a definite plan, based upon the actual conditions to be met, the objects desired can be but partially realized, if at all, and serious complications arise which make the experiment dangerous and unwarranted.

Four main arguments are used in urging Institute men to ratify this proposed alliance: (1) that it will bring in money; (2) that it will save money; (3) that it will broaden the Institute education; and (4) that it will promote the cause of higher education. Even were all these advantages to be secured, theoretically, through an alliance with Harvard, the faculty and former students of the Institute object, by an overwhelming majority, to the practical means proposed. By this "proposed agreement" Technology is called upon to sign a contract vague and unbusinesslike in form, revocable at the will of either party, wholly contingent upon legal interpretations and decisions, pregnant with misunderstandings, and requiring the Institute to assume most of the present burdens and, in case of rupture, all future losses. The plea that this is a "gentlemen's agreement" does not reassure men accustomed, as are those of the Institute, to reading contracts and weighing their probable results. Long experience has taught them that such documents must sooner or later face the courts and that the law reads them as they are written, not as "gentlemen" may be willing to interpret them.

This "agreement," moreover, requires the Institute to bury all her present resources in real estate near enough to Cambridge to share the disadvantages of that locality, but not near enough to partake of the real advantages of the collegiate environment; forces her to agree to reimburse the University in the event of annulment of the contract; and compels her to reorganize her government, to limit her choice of an executive board, and radically to change a policy which has given her the prestige she now holds—a prestige which has been attained, moreover, only because of her unique position as an independent institution.

Setting aside the question of the moral right of the University, even though she may secure legal permission, to divert bequests from their intended purposes, and assuming that the Supreme Court decides that a part of the McKay money may legally be spent at the Institute, even then this highly objectionable "agreement" does not achieve what it is supposed to accomplish. Were it to be ratified, the Institute, for a generation to come, would secure from Harvard only money enough to pay the cost of teaching the Lawrence Scientific School students and would be compelled to bear the whole burden of providing for the natural expansion of the combined institution.

The McKay endowment, under this plan of alliance, would yield to the Institute only three-fifths of the income of the net income of the estate for about fifty years, and the sum then available would be only three-fifths of the income of the accumulation of about five million dollars. To offset this, however, the Institute would lose at least two million dollars in bequests contingent upon her independence, would undoubtedly forfeit state support, and, most serious of all, would almost wholly cut off the present and future financial support (direct and indirect) of the more than six thousand former students who are now enthusiastically ready to assist her.

The plan of alliance will not save money for the Institute because it does not and—except by giving a cheaper and less thorough education—can not avoid duplication in either instruction or equipment. To save money in administration (following the example of business "mergers") is possible, but only on condition of making the Institute an integral part of Harvard University.

The plan will not really broaden the educational life of the Institute; it will merely substitute for the well recognized and thoroughly tested spirit of Technology the different spirit of the University. The students of the Institute, already pressed with the necessary work of their own courses, could find no time for intercourse with those of Harvard, even were they to be admitted (as Dr. Pritchett says they are not) to the undergraduate classes of the University. The association of Harvard and Institute professors upon one faculty is likely to lead to friction rather than to educational development, since the Harvard members to be injected are mainly heads of established courses. As to the broadening which is supposed to come from paying larger salaries to teachers, that can not take place for at least fifty years, since neither the "proposed agreement" nor the McKay endowment (until the death of the last annuitant) can provide higher salaries.

The projected alliance, finally, will injure, not help, the cause of higher education: (1) because it does away with competition, that leading stimulus to educational development; (2) because it creates a school too large for the only right kind of higher education—that which places every student under the immediate supervision of one or more members of the faculty; (3) because it restricts the choice of youth seeking a higher technological education to one kind of institution in this educational centre; and (4) because it brings to an end the great endeavor of Rogers, Runkle, Walker and their associates to build up, on a basis of science, modern languages, history and economics, a true university which shall meet modern conditions and needs more fully than can any of the older colleges.

M. I. T. Alumnus.

Boston, May 15.

The Oscillograph and Its Uses.[1]

By Lewis T. Robinson.

THE usefulness of a satisfactory method of observing or recording the wave forms of rapidly varying electric currents and pressures has been appreciated almost from the time that investigators and designers commenced working with electrical apparatus. The various methods which have been used for obtaining these records or indications have had and are having an important influence on the design of

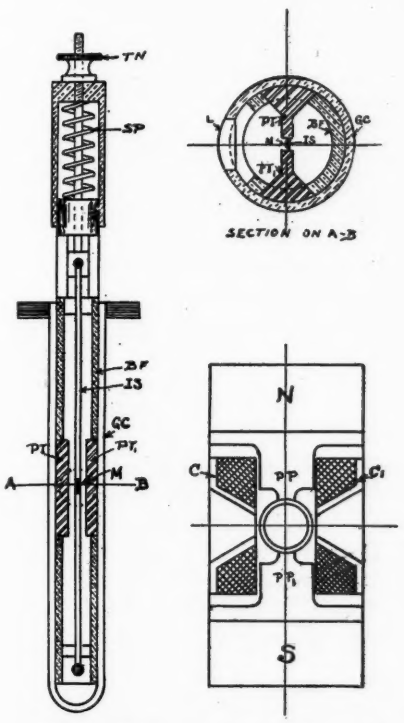


FIG. 1.—GENERAL ARRANGEMENT OF VIBRATING STRIP OSCILLOGRAPH.

apparatus and a clearer understanding of the phenomena accompanying their use.

Instruments for obtaining wave forms divide themselves naturally into two classes; those using point-by-point methods, most generally useful in connection with the investigation of recurring waves, and continuous methods which show recurring waves or record the individual waves. The first class can be traced to a common origin in the point-by-point method of Joubert,[2] and the second to the vibrating-coil device of Elihu Thomson, 1881 (not previously described), and to his later apparatus, and that of Frölich for observing the excursions of a telephone diaphragm acted upon by the current, the wave form of which is to be investigated.

Referring to the point-by-point methods we find, after various modifications, the resulting modern instruments: Hospitalier's ondograph, Rosa's curve tracer, and the General Electric wave meter. While there may be other methods in practical use at the present time, it is believed that these are the only ones which have been used commercially to any extent, at least in this country.

These instruments are not suited to commercial work on instantaneous phenomena, as they require many repetitions of the wave to be viewed or recorded before its complete form is shown. They can, however, be made to operate with very little energy from the circuit to which they are attached and can be constructed to give records of any desired size and of considerable accuracy. These records are, therefore, well suited for analysis and furnish a positive means by which records or observations by the oscillograph may be checked and the absence of errors, due to lack of critical damping and sufficiently high frequency of vibration, determined. No doubt they will for this reason continue to be used although the oscillographs are more universal in their application and may be used to study many events which, by reason of the time required to record a complete wave and the impossibility of reproducing many conditions a sufficient number of times to produce a record by means of succession of points, can not well be handled by any point-by-point method.

The true oscillograph, that is, the instrument with high period, critical damping, and comparatively good sensibility, is to-day existent in two forms, both due primarily to Blondel,[1] who has developed, to a high degree of perfection, the moving iron or vibrating strip type.

This consists of a thin ribbon of iron tightly stretched between the pole tips of a powerful magnet, thus forming a polarized needle, held in position by the directive force of the magnetic field, and, also, by the resistance to torsion of the strip itself. Two small coils, to which the circuit under investigation is connected, are arranged on the sides of this strip in such a way that the strip is acted on by the current flowing in them and at any instant the strip, having the necessary high period of vibration and critical damping, takes up a position which is a measure of the current flowing in the coils at that instant. A minute mirror is attached to the middle portion of this vibrating strip and a beam of light reflected from its surface can be made, by suitable means, to render the wave of current in the coils visible, or to record it on a suitable photographic surface. Fig. 1 shows the general arrangement of the parts.

In the plan view "C," N and S are the poles of the magnet. PP and PP_1 are the pole pieces. C and C_1 are the coils. And in the enlarged sectional plan "D," M is the small mirror attached to the vibrating strip. GC is the insulating tube and PT are the pole tips which concentrate the field on the vibrating strip IS.

The alternate type, or the vibrating-loop construction, is in reality a D'Arsonval galvanometer in which two small metallic bands constitute the moving coil, as well as the suspensions. These are located in a strong magnetic field and the varying current to be investigated is led through the strips in opposite directions. The current flowing through the strips will then, at any instant, bend them in opposite directions, with reference to the field in which they are situated, and a small mirror, attached by its edges to the middle portion of the strips, will be deflected. The deflection of this mirror can be used, as in the first mentioned type, to indicate or record the wave form of the current passing through the strips. Fig. 2 shows diagrammatically the strips in the magnetic field, traversed by a current, with the mirror deflected. At this point

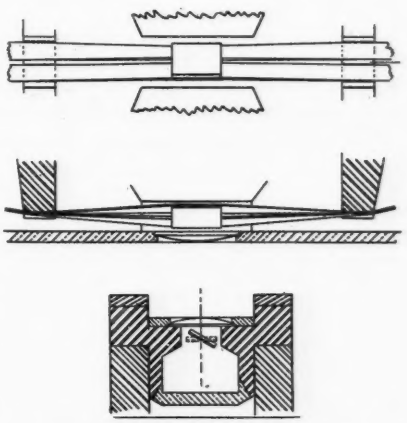


FIG. 2.—ARRANGEMENT OF VIBRATING LOOP OSCILLOGRAPH.

[1] Abstract of a paper read before the American Institute of Electrical Engineers, New York, April 28, 1905.

[2] *Comptes Rendus*, vol. xci, 1880, p. 161; *Journal de Physic*, 1881.

[1] *Comptes Rendus*, April, 1898.

we may consider briefly the advantages and disadvantages of the two types.

An oscillograph, to give satisfactory results, should have:

1. A short free periodic time compared to the period of the wave forms being recorded.
2. Critical damping, that is, the motion just ceases to be oscillatory.
3. Negligible self-induction.
4. Sufficient sensibility.[1]

And we might add the fifth consideration: the instrument should be so constructed that the working parts are readily accessible and of sufficient size so that they may be renewed or repaired by persons ordinarily skilled in the handling of testing instruments.

Referring to these various conditions in the order given, it is undoubtedly true that the iron-strip type can be made to have a shorter free periodic time than the vibrating-loop type, unless the dimensions of the parts in the latter are reduced to an impossible degree.

Both types can be given critical damping.

The vibrating-loop type is superior as far as negligible self-induction is concerned, and it is believed that it can also be operated with less expenditure of energy than the iron-band type.

For practical work it is, in most cases, not necessary to use a periodic time shorter than that which can be conveniently obtained with the vibrating-loop type, and it is also believed that the negligible self-induction and small resistance of this type are of the greatest advantage when large currents, especially unidirectional ones, are to be dealt with. Cases have frequently arisen in practice where such currents of several thousand amperes have been measured by passing them through shunts, similar to those used in connection with direct-current moving coil ammeters, which is believed could not have been successfully handled with the iron-strip type.

Referring to accessory parts of the oscillograph, the arrangements which have been adopted for photographing and viewing the waves exist in great variety and have been developed to meet the special requirements of various investigators. We shall, however, describe those only which have been adopted for the instrument with which the writer is most familiar.

The instrument consists of a light tight box, Fig. 3, in which is placed a three-element galvanometer, and to which are attached devices by means of which the waves may be viewed, or photographic records of them taken.

The three-element galvanometer is shown complete in Fig. 4, and one moving element removed from it in Fig. 5. The details of the containing-cell which is inserted and held between the pole pieces of the magnets, and in which the vibrator is inserted, are shown in Fig. 6.

The principle on which the instrument operates has already been referred to in speaking of the vibrating-loop type in general. The three elements of the galvanometer are entirely complete within themselves, with the exception of the magnetizing coils, and can, therefore, be insulated from one another to stand almost any required pressure. It is then not necessary to insulate the vibrating loop from the frame which holds it, or to rely for insulation on the somewhat uncertain condition that the vibrating loop can always be kept a safe distance away from the pole pieces, between which it moves. In fact, it has been found desirable in most cases actually to connect the strips electrically to the magnet, between the poles of which they are located. In the instrument shown, a pressure of 5,000 volts has been applied between the separate galvanometer elements and between all of these and the frame to which they are attached.

Referring to Fig. 5, it will be seen that the vibrating strips, when the vibrator is removed from the containing-cell, are exposed on all sides; this is of the greatest advantage in restringing the vibrator and making any required adjustments to the moving parts. The vibrating strips, and

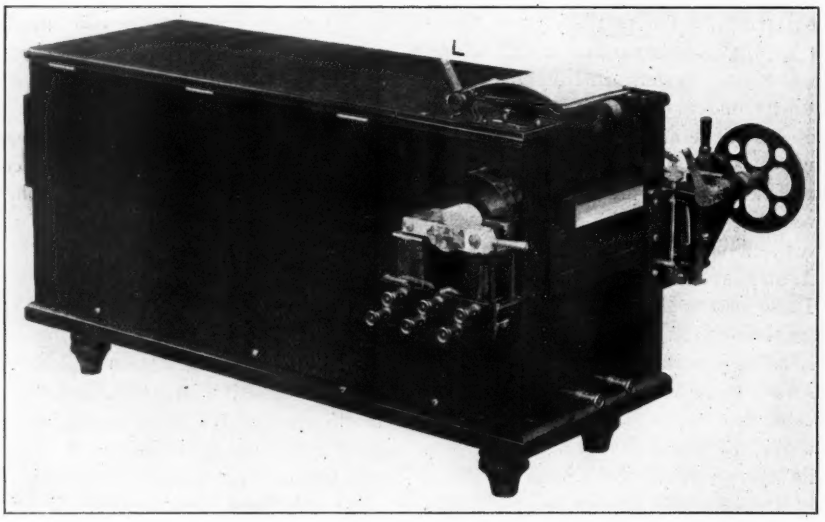


Fig. 3.—Type EM, Form B, Oscillograph, Showing Photographic and Tracing Attachments.

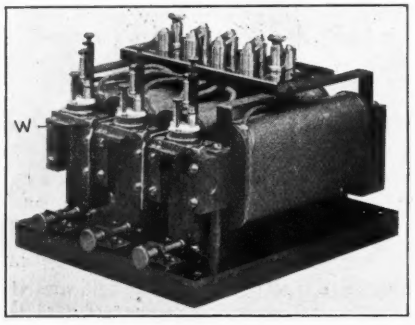


Fig. 4.—Type EM, Form B, Oscillograph—Galvanometer.

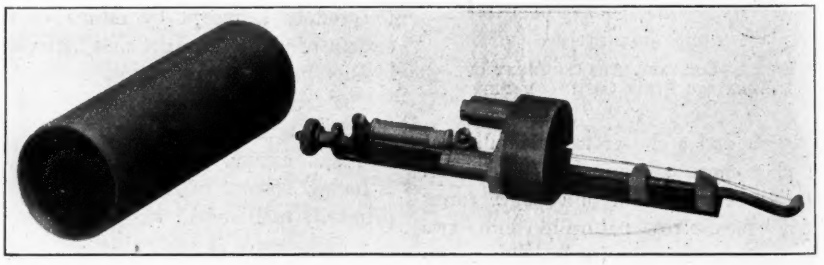


Fig. 5.—Vibrator for Oscillograph.

[1] Duddell, Institute of Electrical Engineers' Journal, vol. xxviii, No. 138, p. 7.

consequently the mirror to which they are attached, can be moved around a vertical axis passing through the centre of the mirror by means of the knurled head on the worm W, Fig. 4. The containing-cell as a whole is movable around a horizontal axis passing through the same point by means of the screw S, Fig. 4.

These two adjustments make it possible to bring the image of the mirror into the desired place on the photographic film or vibrating mirror, even though it has been attached to the vibrating strips in a somewhat imperfect manner. The containing-cell is filled with a damping liquid above the level of the bridge B, Fig. 6. The vibrating loop is usually made of pure silver hard drawn, and the mirror of silvered glass.

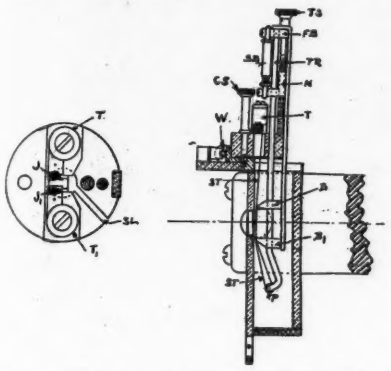


FIG. 6.—DETAILS OF THE CONTAINING-CELL.

Referring to Fig. 6, TT_1 are the terminals conveying the current to the strip ST through the soldered joints JJ_1. By means of the slit SL the loop is placed in position without being passed through any holes. CS is the clamping screw by means of which the removable vibrator is held in the containing-cell. TR is the tension rod attached to the block FB through which the pull of the spring balance SB is transmitted to the pulley P. TS is the tension screw by means of which the tension is regulated by moving the tension nut N.

In a standard pattern the period is one five-thousandth second, the sensibility about 0.007 ampere per millimetre deflection, and the resistance about one ohm.

The dimensions of the mirror which is employed are 80 by 20 by 10 mils, which is large enough to be easily handled and admits of a better photographic record than a smaller mirror. It is, of course, possible, by employing smaller mirrors, to obtain higher frequencies, up to, perhaps, 10,000; but unless such a high frequency is absolutely necessary, the advantages are more than outweighed by the difficulty in handling the very small mirror required and of reflecting sufficient light from its surface.

The advantage of silver over phosphor-bronze which has usually been employed for the vibrating loop is considerable. The resistance, and consequently the energy required to operate the vibrator, is by this means much reduced, which permits current waves to be taken with shunts having comparatively small fall of pressure, and the danger of creeping of the reflected image, due to expansion of the strips on account of the current passing through them is entirely overcome. With high-resistance alloys this is one of the limiting features.

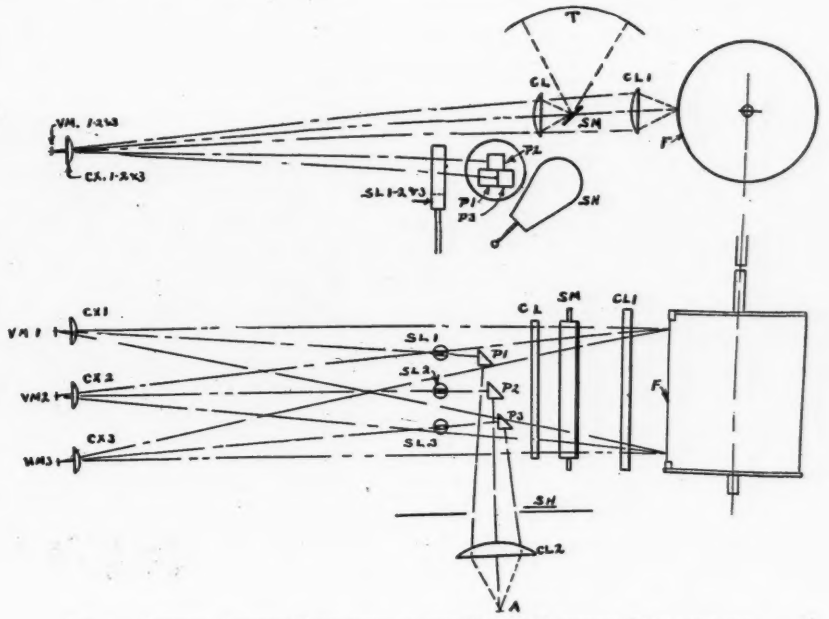


FIG. 7.—OPTICAL SYSTEM EMPLOYED IN THE THREE-ELEMENT OSCILLOGRAPH.

The optical system employed is shown in Fig. 7. We have here the source of light at A, usually an arc lamp; the condensing lens CL_2, by means of which very nearly parallel beams strike the three small prisms P_1, P_2, and P_3, and is, by this means, split up into three portions, which are directed on to the vibrating mirror *v m*, 1, 2, and 3, and from these are reflected to the photographic drum F or to the synchronous mirror SM, from which they are reflected on to the surface T where they may be viewed or traced.

In front of the photographic film is a cylindrical lens CL_1, and in front of the synchronous mirror a cylindrical lens CL. The synchronous mirror and its cylin-

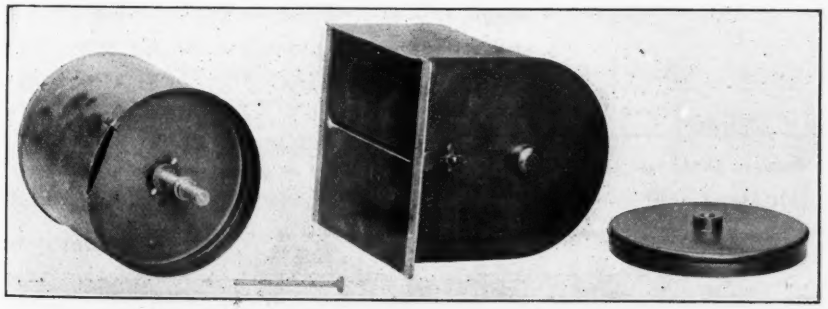


FIG. 8.—TYPE EM, FORM B, OSCILLOGRAPH—FILM HOLDERS FOR PHOTOGRAPHIC ATTACHMENT.

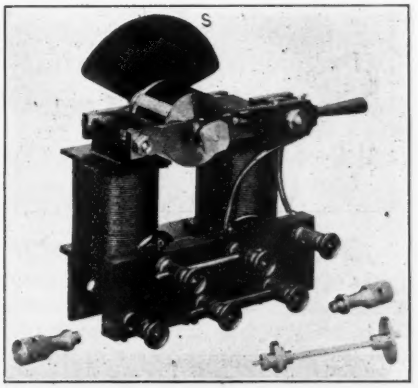


FIG. 9.—TYPE EM, FORM B, OSCILLOGRAPH—SYNCHRONOUS MOTOR.

drical lens are removed from the path of light when photographic record is to be made, in a manner which will be described in connection with the general arrangements for viewing the waves.

The light from the arc lamp is intercepted by the shutter SH, which is operated by electrical contacts by the arrangement shown at the right of Fig. 3. The shaft which operates the shutter contacts is also arranged to drive the photographic drum and usually receives its motion from a small electric motor, the motion of which is transmitted from a cone pulley through a countershaft. By this means speeds of from 6 to 600 revolutions per minute of the drum may be obtained, with a wide range of intermediate values. The photographic drum is shown in Fig. 8.

The shutter operating mechanism is so arranged that the shutter SH, Fig. 11, is open during one revolution of the drum, and for this purpose two devices are employed. In the first the shutter is opened just after passing the joint in the film and is closed when the joint is again reached. The cylinder which carries the contacts by means of which the shutter is opened and closed may be advanced by means of spring pin and holes in the ends of the cylinder, so that time required by the shutter to open may be allowed for. The adjustment required varies with the speed at which the photographic drum is rotated. For obtaining records where it is not possible to wait for the joint in the film before the exposure is made, the second device has been provided; this opens the shutter at any required instant and allows it to remain open for one revolution.

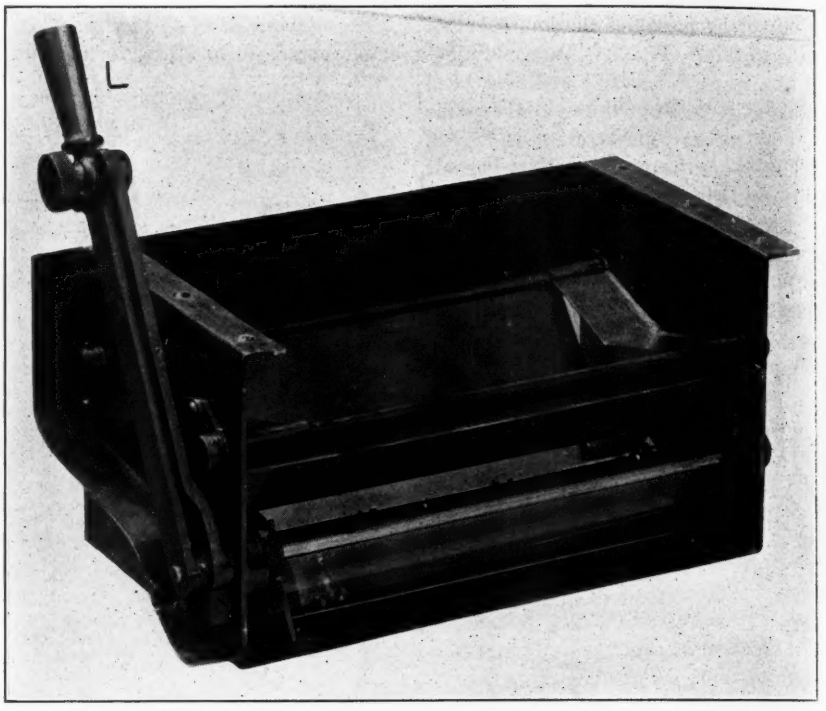


FIG. 10.—TYPE EM, FORM B, OSCILLOGRAPH, SHOWING LENSES AND SHUTTER.

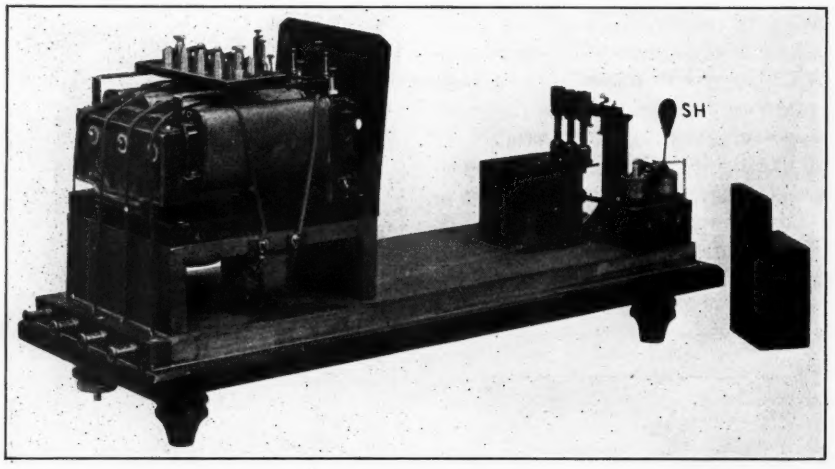


FIG. 11.—TYPE EM, FORM B, OSCILLOGRAPH, SHOWING INTERNAL ARRANGEMENT.

For viewing recurring waves the arrangement shown in Fig. 9 and Fig. 10 is used. By means of the lever L, shown in Figs. 3 and 10, the lens and vibrating mirror are lowered into the path of light and the shutters, which can not well be shown, but which close the opening to the tracing surface T, Fig. 7, are opened. The synchronous motor and mirror driven by it then being in operation and the shutter SH open, to allow the light to pass along the path indicated, the wave is visible on the surface T.

The vibrations of the mirrors having been adjusted to have a suitable amplitude, and the synchronous mirror being moved through a suitable angle during one complete cycle, the point of light on the surface T will move through a path equivalent to the figure obtained when the wave is plotted to rectilinear coordinates. As the mirror returns to its original position the shutter S, Fig. 9, cuts off the light and again allows it to pass when the mirror again moves in the di-

FIG. 12.

Spoken word "Oscillograph." Vibrator was connected in secondary of small transformer, primary of which was connected to battery and telephone transmitter.

rection first indicated. This prevents the admission of light to the surface when the mirror is not moving in the proper direction. Fig. 11 shows the internal arrangement with cover removed.

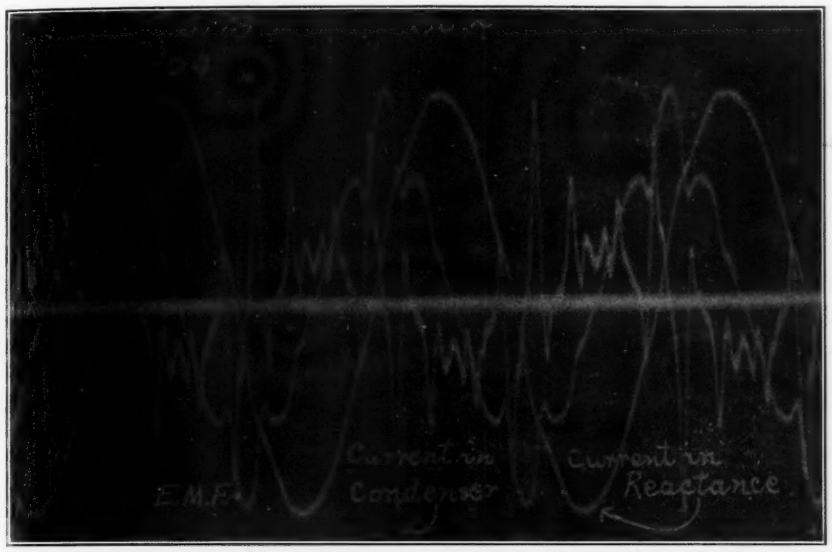


FIG. 13

Impressed electromotive force. Current in reactance. Current in condenser. Reactance and condenser connected to same electromotive force. Reactance without iron core. All three waves recorded simultaneously and having common zero. In Fig. 14 the records were made simultaneously but with separate zero lines.

Given an apparatus similar to that just described we can see and record waves of current and electromotive force in any circuit which can furnish sufficient energy to operate the device, and the frequency of which is not too high to be correctly recorded by it. In general it may be said that a frequency in the neighborhood of 5,000 is sufficient for handling most phenomena which occur on circuits up to and including those having a fundamental frequency of 125 cycles.

The tests in which such a device has been found useful are of such great variety that it is possible to allude to them only briefly and in a general way. The accompanying records which have been taken will, in connection with the description given with each one, show the field of usefulness of the instrument better than it can be described in words.

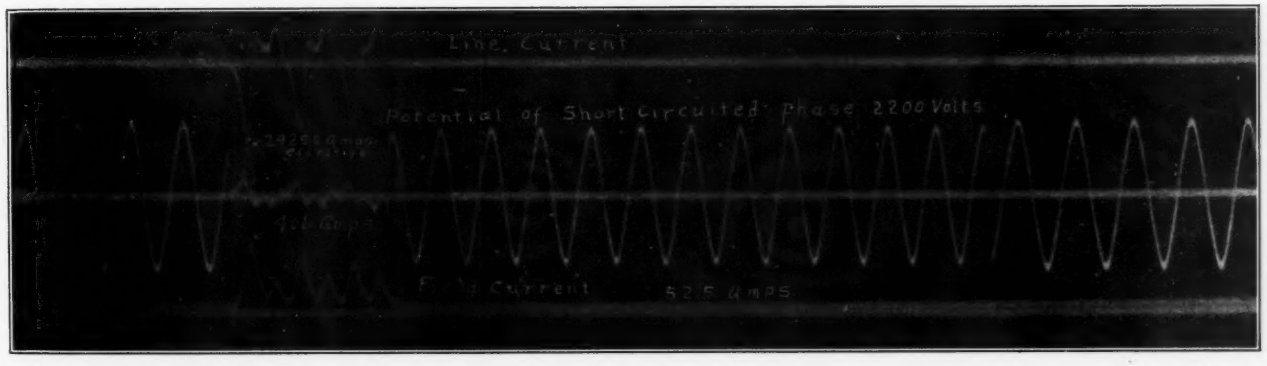


FIG. 14.

Short-circuit applied to large alternating-current generator and opened by automatic oil-switch. The film shows the current and pressure of the short-circuited phase and the reaction of the armature current on the direct current in the generator field; 25 cycles, 2,200-volts.

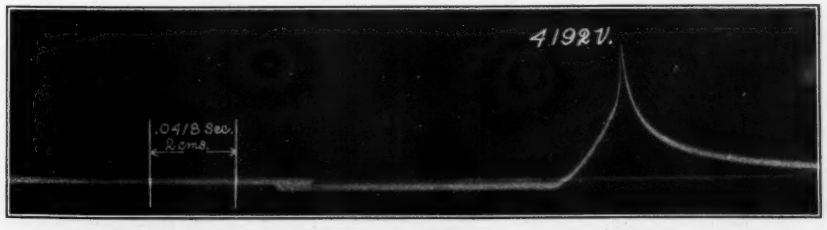


FIG. 15

Inductive rise of pressure in direct-current motor. Shunt field opened by quick-break switch.

The Trinidad Electric and Tramway Power Plant.

W. R. Holloway, consul at Halifax, N. S., reports that a number of Canadians who are taking an active part in the development of the British West Indies have realized a handsome profit from the advance in the price of the stock of the Trinidad Electric and Tramway Power plant at Port-of-Spain, Trinidad. Not only has the value of the stock increased by $750,000, but dividends of five per cent have been paid for two years, and the net earnings are equal to eight per cent on the capital earnings, which continue to show heavy increases month by month.

A still greater and more expanding revenue will be assured with the carrying out of the proposed extensions through a populous and fertile country to larger towns in Trinidad. The present power station is sufficient to supply not only the interurban tramway connection, but light and power for these further demands upon it.

Electric Cabs in Buenos Ayres.

The Compañia Alemana Transatlántica de Electricidad (the German Transatlantic Electric Company), with head offices in Buenos Ayres, Argentine, controlling the electric lighting and street railways of that city and suburbs, is making an endeavor to supplant with electric vehicles the 3,000 cabs used in the city. The company intends ordering 100 electric cabs by way of experiment. The vehicles will be mainly of the light pattern, and will not depart from the style of light victoria which has proved so successful in the present cab service. Mr. A. M. Beaupre, the American minister, suggests that the electric vehicle will come into great favor in the South American city. It will be necessary for American manufacturers to establish agencies to carry in stock all the parts of the machines, for, until a purchaser is assured that he can have missing or broken parts replaced without the delay involved in sending to the United States, the American manufacturers can not hope to make many sales.

THE PRODUCTION AND USE OF ELECTRICITY IN A RUSSIAN PETROLEUM FIELD.

BY FRANZ KOESTER.

North of Baku, which is the most important commercial city on the Caspian sea, lies the largest petroleum producing district on the Apsheron peninsula, in which are the villages of Sabuntschi, Romani, Balachani and Sabrat. About 2,000 wells in this field have been producing in recent years about 70,000,000 barrels annually.

Heretofore the power for drilling and pumping these wells was generally furnished by twin slide-valve engines of thirty to forty horse-power, which were kept in stock by local dealers by the dozen. Steam for these engines was furnished by central boiler plants at a pressure of about sixty pounds through long lengths of steam pipes leading to the different engines 500 feet or more distant. Only in later years did they take the trouble to cover these pipes, and hence the use of steam was very wasteful. Crude petroleum was burned under these boilers which, at fifteen kopeks per pud (about $1 per barrel), cost per month $450 to $600 per well.

As it is easily possible to distribute electricity at high voltage over a wide field without much loss, it was considered profitable to use this means in the petroleum fields, replacing these wasteful steam plants by motors. This is not only much cheaper in actual operation, but it is much safer from a fire standpoint, and it saves a great deal of space, because the law requires a steam boiler to be at least 130 feet from the nearest well. The law also requires that during the boring of a new well all boiler fires within 328 feet (100 metres) of the well must be extinguished until the well is completed and under control. The saving of space on account of displacing boiler plants is of great importance, especially to small fields, where they utilize all possible space for drilling new wells.

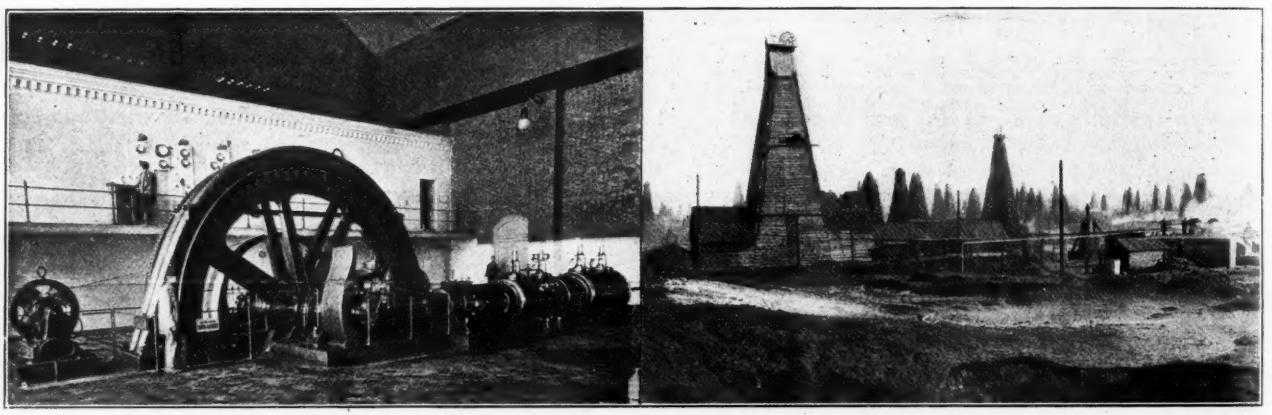
Recently a company was formed for building an electric power plant of 1,500 horse-power in the city of Baku for supplying current to operate the petroleum field. The plant is located about 650 feet from the sea, from which it obtains condensing water. It was not located directly in the petroleum field, because there was no supply of condensing water; and the only source of boiler feed water would have been distilled sea water, which was very salt. Water from wells in that district was not available.

There are four Steinmüller tubular boilers of 3,000 square feet heating surface each, with superheaters in the boiler setting. Steam is furnished at 175 pounds pressure, superheated up to 425 degrees Fahrenheit. Waste product (masut) from petroleum refineries is used for fuel. It is pumped directly from the refineries to two 1,000-barrel tanks near the boiler house, from which it runs to the steam injectors at the furnaces. A small auxiliary boiler of seventy-five square feet heating surface supplies distilled sea water for replacing wastes in connection with the surface condenser. The water from the surface condenser is collected in a cistern in the boiler house, where the cylinder oil is extracted. This feed water is pumped through an economizer of 3,000 square feet, placed in the smoke flues.

The high-pressure steam piping is constructed on the complete ring system, and is so designed that the plant may be enlarged without interfering with continuous operation. There are two triple expansion poppet valve engines made by Ersten Brünner Maschinenbau Fabrik. These are both of the same size, each having two tandem horizontal high and intermediate pressure cylinders, seventeen inches and twenty-seven inches diameter on one end of the shaft, while a low pressure cylinder of forty-three inches diameter is connected to a crank at 120 degrees on the other end. The stroke is forty-three inches, and at eighty-three revolutions the engine delivers 750 horse-power net. Each engine is provided with its own surface condenser. The air pump and circulating pump constitute one machine, installed in the basement of the engine room.

A three-phase alternating-current generator is built on each engine shaft. Each one has a capacity of 700 kilowatts. The voltage is 6,500, at 100 cycles. These generators were manufactured by Allgemeine Elektricitäts-Gesellschaft, of Berlin. A twenty-ton traveling crane with sixty-four-foot span serves the machinery in the engine room. Each generator has its own switch-panel, carrying the necessary apparatus and switches. There are two other panels: one for the phase-indicator, for making parallel connections, and one for the exciter. The exciter is driven by a belt from the engine shaft, as shown in the illustration. The switch panels are of white marble, without iron frames, and are bolted direct over openings in the division wall. All instruments on the front of the switchboards handle low-tension current, while the high-tension levers are behind the division wall in the switching room. In the basement of the switching room are the bus-bar ring system, high-tension fuses, measuring transformers, etc.

Two separate high-tension wire systems are carried on wooden poles seven miles to Sabuntschi, where they enter a tower, and pass down underground. The overhead wiring is well protected with horn lightning arresters, and is provided with wire netting suspended under the wires from pole to pole. The three-core underground cable is lead covered, and has a



INTERIOR OF POWER-HOUSE AND A FOREST OF OIL DERRICKS IN A RUSSIAN PETROLEUM FIELD.

cross-section of thirty-five square millimetres for each wire. There are three transformer stations, so arranged that any one of them may be switched from the tower onto either wiring system. In each transformer station there is a group of three transformers, stepping down from 6,000 to 1,100 volts. The secondary current is distributed over the oil fields by lines strung on wooden poles.

When electric motors were first introduced they were generally set up on the old engine foundations, and belted to the rigging, the same as the engine; but it was soon found that owing to great danger from fire it was better to build a separate stone house to contain the motor, some ten feet distant from the wooden derrick house. These motors are thirty to fifty horse-power at 1,000 volts, and are specially built for this service. They have two separate field windings; one for starting up and running without load, and the other for normal working. When the motor is started and reaches the proper speed the normal field is automatically switched in. For protection against fire, from gases, the contact terminals are enclosed in air-tight cases.

The power plant was designed and built by the Allgemeine Elektricitäts-Gesellschaft, of Berlin, which also furnished and installed the entire electric equipment.

Three-phase high-tension distribution and motors have proved to be the best adapted for this kind of service. The motors are durable, the most simple, stand variable load, and require the least attention, all of which are most important factors on account of the unskilled labor common in petroleum fields.

Electrical Mining Machinery in South Africa.

In a recent consular report concerning the demand for mining machinery in South Africa, it is stated that a prominent feature in mining gold, tin, etc., in South Africa has been the remarkable increase in the demand for electrically-driven machinery. Hauling, lifting, pumping and lighting are being accomplished by electrical apparatus.

PROGRESS IN THE ELECTROLYTIC ALKALI AND BLEACH INDUSTRY.

BY JOHN B. C. KERSHAW.

INTRODUCTION.

There is no very striking progress to record in the electrolytic alkali and bleach industry during 1904, and the directors of many of the factories in Europe, where these products are made, have found some difficulty in maintaining their plants in full operation. This difficulty has been chiefly due to overproduction in the bleaching powder (hypochlorite of lime) industry, and to the very low prices which can be obtained consequently for this chemical in the open market.

The failure in 1902 to renew the existing sales price agreement between the Le Blanc and electrolytic manufacturers led to a fall of over $9.50 per ton in the price of bleach in Europe in 1903, and although the agreement has been revived during 1904 in a modified form, the price of bleach has not returned to its former level and is still only about twenty-one dollars per ton in Liverpool. The margin for profit on this chemical is therefore small.

Since 2.2 tons of bleach are produced for every one ton of seventy per cent caustic soda by either the Le Blanc or electrolytic processes, the influence exerted by the ruling low price of this chemical upon the economic success of the heavy chemical industry is apparent; and attempts are now being made in many works in Europe to utilize the chlorine evolved from the electrolytic alkali cells in some more profitable manufacture.

Tin crystals, carbon tetra-chloride, pure hydrochloric acid, and a bleaching solution for wood pulp are some of the new chloride products to which those in charge of these works are directing attention; and in addition to these electrolytic chloride is being employed on a very large scale in the manufacture of artificial indigo. The necessity for turning all the by-products of the electrolytic alkali and chloride industry to account has also led to renewed attempts to make some use of the hydrogen escaping from the cathode compartment of the cells; and in Italy this is being employed to produce pure hydrochloric acid, while in Germany it is collected, purified, dried and sold compressed in cylinders for balloon and other purposes. As regards the position of the industry in the various countries, the following notes will be of interest.

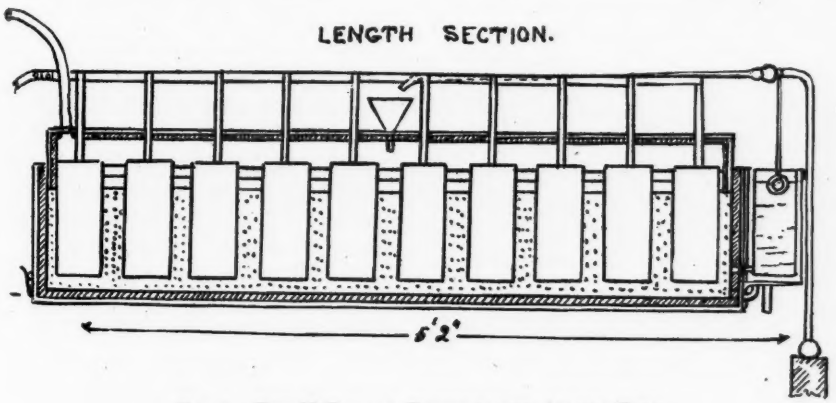


FIG. 1.—THE MCDONALD ELECTROLYTIC ALKALI CELL.

UNITED STATES.

The Castner-Kellner, Acker and Roberts cells are being extensively worked at Niagara Falls, but there is nothing new to report concerning these processes. Caustic potash and pure hydrochloric acid are made by the Roberts process, while caustic soda and bleach are the chief products of the other two companies, which together utilize from 7,000 to 8,000 horse-power. The Acker Process Company, however, has added carbon tetrachloride and tin crystals to its manufactured chlorine products.

The Bell Brothers cell is operated by the Pennsylvania Salt Company at Wyandotte, Mich. This is a mercury process, and the movement of the latter is effected by the pressure of the chlorine in the anode compartment of the cell. According to recent reports, the process is not yet working very successfully.

The Dow cell is of the diaphragm type and is operated by the Dow Chemical Company at Midland, Mich., with a plant having an annual capacity of 20,000 tons bleach. The Moore cell is another diaphragm type of cell, and is in use at the new works of the American Electrolytic Company at Rock Glen, Buffalo, N. Y.

The American Alkali Company, which was formed to work the Rhodin cell and process at Sault St. Marie, shut down its plant toward the end of 1902 owing to the fall in the price of bleach—and litigation followed a call upon the preferred shareholders for further capital. The case was won by the defendants who resisted the call on the ground that misleading statements had been published by the promoters of the company. So far, as the writer is aware, the works of Sault Ste. Marie are still closed.

A new type of diaphragm cell patented by McDonald has been introduced in America, and an installation of eighty cells of this type is in actual operation at the Clarion Paper Mills, Johnsonburg, Pa., and has been described by Ulke. Carbon anodes and iron cathodes are em-

ployed, and fifty-seven horse-power is said to yield one ton of bleach. The Standard & Colorado City Chlorination Company is reported to be about to install a large plant of these cells for production of the chloride required in opening up its ores. Figs. 1 and 2 are sectional drawings of the McDonald cell.

UNITED KINGDOM.

The Castner-Kellner Alkali Company and the Electrolytic Alkali Company continue to operate the Castner and the Hargreaves processes at Weston Point and Middlewich respectively, and the two works utilize about 7,000 horse-power in the manufacture of caustic soda and bleach.

The low prices obtained for the latter product during 1903 and 1904, however, have reduced the profits of each company seriously, and dividends have been cut down by the Castner-Kellner Company and passed altogether by the Electrolytic

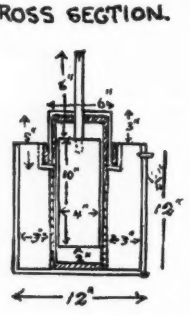


FIG. 2.—MCDONALD ELECTROLYTIC ALKALI CELL.

Alkali Company. The first-named company is now taking up other manufactures, and is devoting some portion of its chlorine to the production of zinc-chloride by the Swinburne-Ashcroft process, while the Middlewich company is devoting some portion of its capital and plant to the manufacture of fine salt; the brine being obtained from its own sources of supply on the property at Middlewich in Cheshire.

FRANCE.

Only two companies are producing alkali and bleach in France by electrolytic processes—namely, the Société Industrelle des Produits Chimiques at La Motte, and the Société la Volta at Montiers. The first employs the Griesheim cell and process, the second the Outhenin-Chalandre cell and process. Owing to the fall in the value of bleach neither company is making much headway, and at Montiers portion of the chlorine is being devoted to the production of carbon tetrachloride.

GERMANY.

There is little that is new to report concerning the progress of the industry in Germany. The Aussig bell (gravity) cell is stated to be in successful operation at Bitterfeld, at Grappin, and at Salbe-Westerhüsen. The Bitterfeld and Rheinfelden companies have amalgamated, and the capital of the former company has been increased in order to take over the shares of the Rheinfelden company. The dividend of the Chemische Fabrik Griesheim (the parent Electrolytic Alkali Company in Europe), which patented and exploited the "elektron" cell and process, estimated to be eleven per cent for the year 1903, but as this firm manufactures many chemicals other than caustic alkalies and bleach, it would be a mistake to assume that this profit had been earned solely by the manufacture and sale of the heavy chemicals. A considerable revenue is no doubt derived from royalties on the "elektron" cell and process, which is used in a very large number of subsidiary works in Germany, France and Russia. The great German dye works of the Baden Anilin and Soda Fabrik are reported to have a 3,500-horse-power plant in operation, using the Griesheim cell; the soda and chlorine produced being utilized on the spot in the manufacture of organic chemicals and dyes. The German Electrolytic Alkali Works is estimated to produce 50,000 tons bleach per annum, and to waste 500 tons of hydrogen.

RUSSIA.

The progress of the electrolytic alkali industry in Russia, as in the case of all skilled industries, has been hampered during 1904 by the war, and no information has been published relating to its present position and prospects. Two works were in operation at the commencement of the year at Zombkowice and at Slaviansk the former using the "elektron" cell and process, and the latter that patented and exploited by the Bitterfeld Company. Probably both of the works have been shut down, owing to the calling out of the reserves.

AUSTRIA.

Some modification of the Kellner mercury cell and process is operated at Hallein, but no reliable information concerning this plant, which has over 3,000 horse-power available, has been published. The chlorine is probably used on the spot in the manufacture of wood pulp. At Aussig 1,400 horse-power is utilized by the bell (gravity) type of cell, and early in 1904 another 800-horse-power unit of plant was reported to be in course of erection at these works.

ITALY.

A modified form of the Outhenin-Chalandre cell and process is worked at Piano by the Sociéta Elettrochimica Italiana and 6,000 horse-power is reported to be utilized by this company in the manufacture of alkali and bleach, chlorates, carbon tetrachloride and pure hydrochloric acid. The same company has another works at Bussi where only the heavy chemicals—caustic soda and bleach—are produced, the capacity of this plant being 3,000 tons caustic soda and 6,000 tons bleach per annum. Elter in a recent report upon electrochemical industry in Italy states that the financial results of these works have been disappointing, owing to the unfavorable position of the factories, and the high price of salt. This non-success has reacted upon the development of other schemes for utilizing the enormous water power of Italy in the alkali and chlorine industry.

SPAIN.

An electrolytic alkali works using the Griesheim "elektron" cell and process has been in operation at Flix on the Ebro since 1899. The output of caustic soda is estimated to be 2,500 tons per year, and since Spain imports 30,000 tons annually of this chemical, there should be ample room and opportunity for expansion of the industry.

Important contributions to the theory of the alkali chloride cell have been published during 1904 by Steiner, Guye and Adolp and will be found in the issues of the *Zeitschrift für Elektrochemie* for May and July, 1904, and abstracted in the *Elektrochemische Technik*. Steiner's investigation related to the bell (gravity) type of cell. This chemist found as the result of his laboratory investigations that a current efficiency of between eighty-five and ninety-four per cent could be maintained with an electromotive force of 3.7 to 4.2 volts, and a current density of two to four amperes per square diameter centimetre. Under these conditions a concentration of 130 grammes per litre of potassium-hydrate could be attained. The vertical distance of the lower anode surface from the edge of the bell was found by Steiner of great importance in its bearing on the results obtained with this type of cell.

A German medical commission has also reported during 1904 upon the curious skin disease known as "chlorine-ache," to which men engaged in electrolytic alkali works in Germany are subject. Frequent lime-washing of the walls, and of the floors of the room containing the electrolytic cells, is recommended as the best preventative of this troublesome disease; the moist calcium hydrate absorbing the gaseous chlorine compounds which appear to give rise to it.

TEST OF A 5,000-KILOWATT ALTERNATOR.[1]

BY L. L. GAILLARD.

The following paper is intended to give a general description of the series of tests made on each of the alternators installed in the Seventy-fourth street (Manhattan) power station of the Inter-

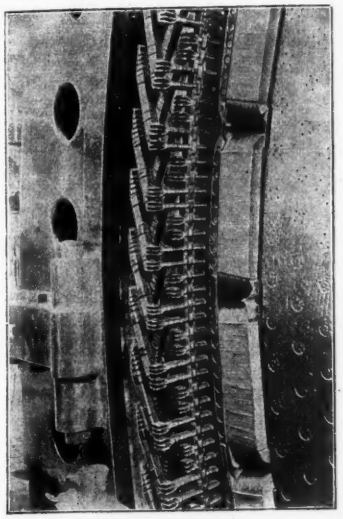


FIG. 1.—ARMATURE AND CONNECTIONS, SHOWING WOODEN BLOCK BRACING BETWEEN COILS.

borough Rapid Transit Company, of New York city. The object of the tests was to obtain characteristic curves of the machines and to determine how nearly they conformed to the contract requirements and the manufacturer's guarantee.

Each machine is a 5,000-kilowatt, 11,000-volt, twenty-five-cycle, seventy-five revolutions per minute Westinghouse alternator, direct-connected to a double horizontal-vertical Allis compound engine.

It may be well to preface the account of the tests with the following extracts

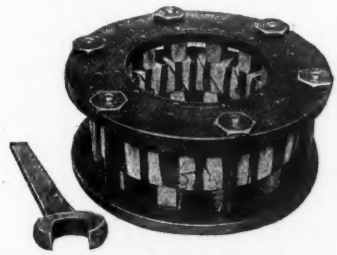


FIG. 2.—LAMINATED RING AND CLAMPING DEVICE FOR DETERMINING QUALITY OF IRON USED IN THE MANHATTAN ALTERNATORS.

from the contract specifications giving certain data obtained from the calculations of the manufacturer, and certain guarantees upon which was based the acceptance or rejection of the machine by the purchaser.

A guaranteed full-load efficiency of 96.5 per cent, to meet which guarantee the total permissible losses in the alternator are therefore 181,300 watts.

The full-load field current equals	202.0	amps.
The full-load armature current equals	263.0	amps.
The armature copper loss equals: $263^2 \times 0.4 =$	27667.0	watts.
The field resistance equals	0.85	ohm.
The resistance of the armature equals	0.4	ohm.
The field copper loss equals: $202^2 \times 0.85 =$	34683.0	watts.
Total copper losses =	62350.0	watts.
Total allowable iron losses, based on 96.5 per cent full-load efficiency, =	118950.0	watts.

The efficiency on non-inductive load will be:

	Per Cent.
At one-quarter load = not less than	90.00
At one-half load = not less than	94.50
At three-quarters load = not less than	95.50
At full-load = not less than	96.50
At 25 per cent overload = not less than	97.00

The efficiencies are based on I^2R loss in the armature and field coils and on the armature iron loss. Friction is not included.

The current in the armature when short-circuited with normal no-load field current, will equal three times full-load current.

The regulation at 100 per cent power-factor will equal 6 per cent.

After running for twenty-four hours at full load at 100 per cent power-factor, the rise in temperature in no part will exceed thirty-five degrees centigrade; and at twenty-five per cent greater load, with the same power-factor, for twenty-four hours, the rise in temperature will not exceed forty-five degrees centigrade.

The following measurements and tests were made on the alternator:

Measurement of armature iron loss. Resistance of armature winding. Resistance of field winding. I^2R loss in armature. I^2R loss in field. Efficiency at various loads. No-load saturation curve. Short-circuit characteristic. Regulation (calculated). Insulation puncture test. Temperature rise under load.

Armature Iron Loss—It being entirely impracticable to measure this loss in the usual manner, the following interesting method was adopted:

The alternator armature is built up of the following amounts of sheet steel worked at magnetic inductions given below:

234,000	cubic inches,	90	per cent	solid, @	65,500 centimetre-gramme-second lines per square inch.
16,500	"	"	"	@	91,100 " " "
20,300	"	"	"	@	76,500 " " "

The iron losses were determined from a measurement of the losses in sample rings made from the material of which the armature was built up. These samples were annealed in the ovens with the armature laminations, were painted the same as these laminations, and then built up into test rings and compressed until their volume contained ninety per cent solid metal. The rings were then wound for test purposes and the losses at the different inductions mentioned above, were measured with a sensitive wattmeter.

The dimensions of the test samples were: outside diameter, twelve inches; inside diameter, eight inches; thickness (compressed to ninety per cent solid), two inches; cross-section, two inches by two inches, four square inches; mean circumference, 31.416 inches; volume, 125.66 cubic inches.

The calculations of ninety per cent solid material in samples were based upon specific gravity tests made on samples cut from the steel bars from which the sheets were rolled. The average specific gravity of several samples was 7.847, which gives 3.91 cubic inches per pound

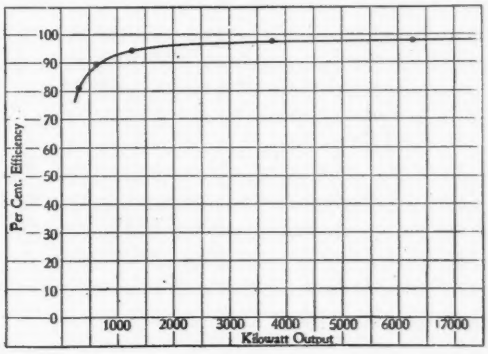


FIG. 3.—EFFICIENCY CURVE OF A 5,000-KILOWATT, 11,000-VOLT ALTERNATOR.

for ninety per cent solid material. The weight of the sample, on the basis of these calculations, should therefore be 32.13 pounds.

About twenty sample rings were built up and each sample was wound with seventy-two turns of No. 18 B. & S. annunciator wire, wound in twelve groups of one layer, and six turns each, with the groups symmetrically disposed around the circumference of the ring.

The iron loss in each sample was measured at each of the three inductions mentioned above, *viz.*:

	C.-G.-S. lines per sq. in.		C.-G.-S. lines per sq. cm.
(*a*)	65,500	=	10,155
(*b*)	91,100	=	14,124
(*c*)	76,500	=	11,860

The voltages required for each of the three inductions at 3,000 alternations were obtained from the following calculations:

B = maximum induction per square centimetre.
E = effective volts.
n = periods per second.
t = number of turns.
a = sectional area in square centimetres.

$$E = \pi\sqrt{2}\, a\, n\, t\, B\, 10^{-8}.$$

Reducing this formula to area in square inches and alternations per minute, we have:

$$E = .2388\, a'\, n'\, t'\, B\, 10^{-8}.$$

Where a' = sectional area in square inches = 4
n' = alternations per minute = 3000

The voltage at the various inductions is then as follows:

(*a*) $E = 0.2388 \times 4 \times 3{,}000 \times 72 \times 10{,}155 \times 10^{-8} =$ 20.96
(*b*) $E = 0.2388 \times 4 \times 3{,}000 \times 72 \times 14{,}124 \times 10^{-8} =$ 29.15
(*c*) $E = 0.2388 \times 4 \times 3{,}000 \times 72 \times 11{,}860 \times 10^{-8} =$ 24.48

[1] The Electric Club Journal, May, 1905.

The losses in the samples were measured by carefully calibrated instruments, and the alternator used for supplying current for the purposes of the test gave a wave of almost exactly sine form.

The average results of measurements on the twenty samples were as follows:

(*a*) 0.1340 watt loss per cubic inch.
(*b*) 0.2220 watt loss per cubic inch.
(*c*) 0.1724 watt loss per cubic inch.

The total watt loss in the armature was, therefore, as follows:

	Watts.
(*a*) 234,000 × 0.1340 =	31,380
(*b*) 16,500 × 0.2320 =	3,821
(*c*) 20,300 × 0.1724 =	3,492
Total	38,693

The impracticability of making an accurate determination of the iron losses after the machine had been assembled is to be regretted, as the method adopted and just described contains probabilities of error which can not be predetermined or eliminated. The armature casting is made in six sections and the sheet-steel laminations are each no greater than six feet in length, thus making in the magnetic circuit six butt and numerous lap-joints. The losses due to these breaks in the magnetic circuit are, of course, neglected when the determination of the iron losses is made in the manner just described, but it is probably that they are of so small a value when compared with the total losses as to be negligible.

Resistance Measurements of Armature and Field—These measurements were made by the usual drop-of-potential method, the temperature of the winding and of the room being observed. The resistances as mentioned were then calculated for a room temperature of twenty-five degrees centigrade and the I^2R losses calculated on this basis.

Resistance of armature:

Phase 1—2 R = 0.2325 ohm at 25 degrees C.
" 2—3 R = 0.2332 " 25 "
" 1—3 R = 0.2329 " 25 "

2 times combined resistance of three phases = 0.2325 + 0.2332 + 0.2329 = 0.6986.

Total armature resistance therefore equals $\frac{0.6986}{2} = 0.3493$ ohm.

Resistance of field at 25 deg. C. = 0.8206 ohm.

Efficiency—As noted above the efficiency is based on the armature iron losses and the field and armature I^2R losses. The iron losses were determined as described above, and from the resistance values as obtained by measurement, the I^2R losses in field and armature have been calculated for various loads from twenty-five per cent to 125 per cent of full rated load. These appear in tabulated form below, and following in a curve plotted from the calculated efficiencies.

In calculating the field I^2R loss, 208.1 amperes was used as full-load field current, this value being obtained in the following manner:

	Amps.
Field current corresponding to terminal voltage on open circuit plus armature resistance drop =	198.5
Field current necessary to give full load armature current or short-circuit, =	62.5
Full-load field current is the vector sum of above, or	208.1

	¼ Load.	½ Load.	¾ Load.	Full Load.	1¼ Load.
Iron loss.....kw.	38.69	38.69	38.69	38.69	38.69
Armature I^2R loss..... "	1.51	6.04	13.59	24.16	37.75
Field I^2R loss..... "	35.54	35.54	35.54	35.54	35.54
Total losses..... "	75.74	80.27	87.82	98.39	111.98
Output..... "	1250.00	2500.00	3750.00	5000.00	6250.00
Input..... "	1325.74	2580.27	3837.82	5098.39	6361.98
Efficiency.....per cent	94.29	96.50	97.71	98.06	98.24

No-Load Saturation—The no-load saturation curve was obtained in the following manner:

The alternator field was excited from a 250-volt steam-driven generator running at constant speed. The alternator, with its armature circuit open, was brought to full speed with the engine on the throttle, and held at this speed while the measurements were made. Simultaneous readings of volts field, amperes field, volts armature and speed were taken. The instantaneous reading of speed were made by means of a frequency indicator which had been previously carefully calibrated. Below is given in tabulated form the instrument readings from which the saturation curve has been plotted. As some of the readings were taken at a frequency higher than twenty-five cycles (due to the engine speeding up), the armature volts at these points were corrected for this difference in speed by decreasing them in proportion to the increase in speed.

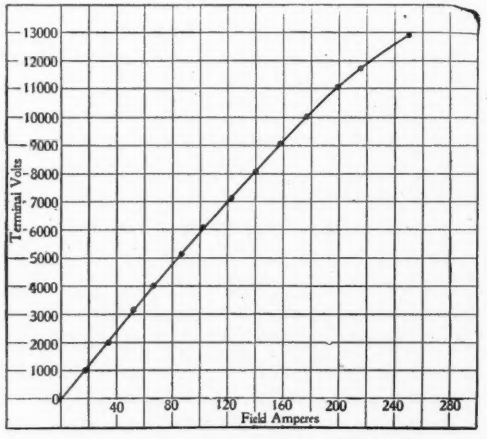


FIG. 4.—RUNNING SATURATION OF A 5,000-KILOWATT, 11,000-VOLT MANHATTAN ALTERNATOR.

Frequency.	Amperes Field.	Volts Field.	Volts Armature. Observed.	Volts Armature. Corrected.
25.0	17.5	15.3	1,000	1,000
25.0	33.5	29.4	1,963	1,963
25.0	51.4	44.8	3,140	3,140
25.0	66.0	57.3	4,010	4,010
25.0	86.0	74.5	5,150	5,150
25.0	101.8	87.3	6,100	6,100
25.2	121.8	103.5	7,190	7,133
25.2	139.0	117.8	8,120	8,055
25.2	157.2	134.8	9,150	9,077
25.2	176.2	150.0	10,100	10,019
25.2	198.0	168.5	11,160	11,070
25.5	214.0	183.0	11,970	11,640
25.2	249.2	218.0	13,020	12,916

Short-Circuit Characteristic—For this test the armature terminals were short-circuited, the alternator run at full speed and the armature current measured at different values of field current. The tabulated readings and the curve plotted from them are given below:

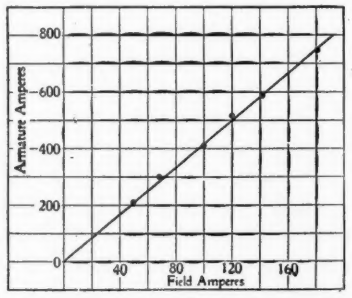


FIG. 5.—SHORT-CIRCUIT CHARACTERISTICS OF A 5,000-KILOWATT, 11,000-VOLT MANHATTAN ALTERNATOR.

Speed R. P. M.	Field Amperes.	Field Volts.	Armature Amperes.
75	50.0	36.0	210.0
75	68.0	50.0	300.0
75	100.0	74.5	411.6
75	120.2	89.5	516.0
75	141.2	105.5	588.0
75	181.0	140.5	744.0
75	193.3	158.0	798.0

Insulation Test—The contract specifications required that after the machine had been assembled the insulation of the field winding from the frame should be subjected to a puncture test of 2,500 volts alternating electromotive force for a period of one minute, and that the insulation of the armature winding from the frame should be tested at a potential of 25,000 volts for thirty minutes.

As the armature coils had been exposed to moisture for some time before being

assembled, it was thought advisable to give them a drying out before subjecting them to the puncture test. For this purpose the armature was short-circuited and the machine run at about two-thirds full speed with sufficient field current to give about 500 amperes in the armature. This heat run was kept on for about sixty hours, then the machine was shut down and the windings carefully wiped off and allowed to cool to the temperature of the room before the insulation test was made.

The insulation tests were made by using a 250-kilowatt, 40,000 : 360-volt twenty-five-cycle oil-cooled transformer, the low-tension winding of which was connected in series with a water rheostat to the 400-volt, twenty-five-cycle station bus-bars. The potential on the high-tension side of the transformer was measured with a 50,000-volt electrostatic voltmeter which had been previously calibrated.

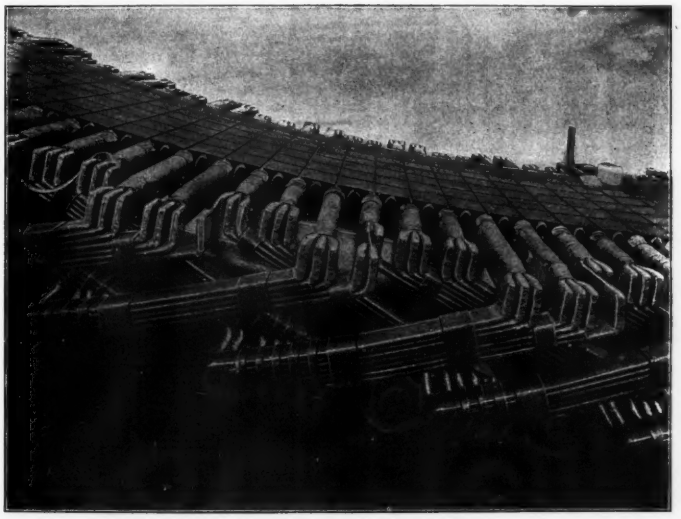


FIG. 6.—END CONNECTIONS OF ARMATURE WINDING.

It may be of interest to note that when the test potential was first raised to 25,000 volts, and for some minutes thereafter, a considerable static discharge was noticed taking place over the surface of the windings. As the test was prolonged, this static discharge gradually decreased in intensity until after the lapse of about twenty minutes it almost entirely disappeared.

Regulation—The specifications for this machine provide that "a load of 263 amperes per terminal at 11,000 volts electromotive force and at 100 per cent power-factor may be thrown off, and the electromotive force will rise six per cent with constant speed and constant excitation."

It has not been found convenient to make an actual measurement of the regulation of the machine, but from the data and characteristic curves it has been calculated. This calculation was made by the usual magnetomotive-force method and the regulation was found to be 4.5 per cent. This figure is undoubtedly too small as this method of calculation invariably gives results more favorable to the machine than those obtained from actual test.

Temperature Measurements—A number of determinations of the temperature rise in field and armature conductors and in armature laminations were made after the machine had been running under load for a sufficient length of time to have reached a constant temperature.

The following results represent the average rise in temperature above the surrounding air of the various parts of the machine after a run of seventeen hours at an average load of 5,000 kilowatts.

Temperature rise above air:

Field winding	22.5	degrees centigrade.
Armature winding	22.6	" "
Armature laminations	25.5	" "

The performance of the eight alternators, of which this one is representative, has been so excellent and the temperature so greatly below the guarantee, that their rating has been increased from 5,000 to 6,000 kilowatts.

Testing Synchronizing Connections—After the first machine had been installed it became necessary to make sure of the correctness of the synchronizing connections of each of the others as it became ready for operation. For synchronizing, dark lamps and a dial synchronizer are used.

To make an absolutely certain test of the synchronizing connections, the following interesting method was adopted: when the second machine was ready for service, the main switches of both Nos. 1 and 2 were closed, tying the machines to the bus. Full-load field current was put on each alternator and both engines were started simultaneously and slowly brought to full speed together. If the lamps remained dark and the synchronizer indicated exact synchronism, no better check could be had on all connections. Had there been any wrong connections in the armature circuit of one machine, making a short-circuit when the two machines were tied together, this would have been indicated on the ammeter in the armature circuit immediately after the machines started. The relay would also have operated immediately to open the armature switch.

After the two machines had been brought to full speed (tied together) they were then cut apart and synchronized in the usual manner. This method was used with great success on all the machines, a separate bus-bar being used for the purpose.

World's Copper Production.

Under date of March 13, 1905, United States Consul R. M. Bartleman, of Seville, Spain, transmits the following statistics of the world's copper production for the last three years, being the translation of an article which appeared in the *Revista de Economia y Hacienda*, Madrid, of March 11. The figures for 1904, although not absolutely accurate, have been obtained through the most reliable source.

THE WORLD'S PRODUCTION OF COPPER IN 1902, 1903, AND 1904.

Country.	1902. Metric Tons.	1903. Metric Tons.	1904. Metric Tons.
United States	294,297	311,536	349,866
Mexico	35,785	45,315	52,500
Spain and Portugal	49,790	49,740	50,000
Chile	28,930	31,100	33,000
Japan	28,775	31,360	32,000
Australia	28,640	29,000	30,000
Germany	21,605	21,205	21,500
Canada	17,485	19,320	21,500
Russia	8,000	10 320	10,000
Cape Colony	4,450	5,230	7,250
Peru	7,580	7,800	7,000
Norway	4.565	5,915	6,000
Italy	3.370	3,100	3,250
Newfoundland	2,000	2,060	2,000
Bolivia	2,000	2,000	2,000
Austria-Hungary	1,500	1,385	1,500
Turkey	1,100	1,400	1,500
Miscellaneous	1,295	1,080	1,300
Total	542,167	578,876	632,166

Spain, which twenty-five years ago was first in the world's production of copper, now ranks third.

The development which has taken place in the world's production of copper since the beginning of the nineteenth century may be observed as follows:

WORLD'S PRODUCTION OF COPPER BY DECADES, FROM 1800, AND IN THE PERIOD 1901-1904.

Period.	Production. Metric Tons.	Increase. Per Cent.
1801-1810	91,000	....
1811-1820	96,000	5
1821-1830	135,000	41
1831-1840	218,400	60
1841-1850	291,000	28
1851-1860	506,999	80
1861-1870	900,000	77
1871-1880	1,189,000	32
1881-1890	2,373,398	86
1891-1900	3,708,901	63
1901-1904	2,269,199	53

New York State Independent Telephone Association.

The annual convention of the New York State Independent Telephone Association will be held at the common council chamber, City Hall, Albany, N. Y., June 16. A good programme has been prepared, and from the present indications the attendance will be large.

The officers of the association are as follows:

H. H. Persons, president, Buffalo, N. Y.

Howard Hendrickson, vice-president, Albany, N. Y.

Boyd McDowell, second vice-president, Elmira, N. Y.

T. Harvey Ferris, treasurer, Utica, N. Y.

T. S. Lane, secretary, Buffalo, N. Y.

The members of the executive committee are H. H. Persons, Buffalo, N. Y.; Geo. R. Fuller, Rochester, N. Y.; B. G. Hubbell, Buffalo, N. Y.; Edward Davis, Binghamton, N. Y.; S. B. Rawson, Albany, N. Y.; J. S. Brailey, Jr., Utica, N. Y.; C. H. Poole, Utica, N. Y.; T. B. Basselin, Croghan, N. Y.; F. M. Potter, Jr., Syracuse, N. Y.; J. F. Stockwell, Oswego, N. Y.

Some very effective work has been done throughout the state during the past year by the organization of district associations, which form a part of the state association. The following districts have been organized:

Buffalo, H. H. Persons, Buffalo, N. Y., chairman; T. S. Lane, Buffalo, N. Y., secretary.

Rochester, Geo. R. Fuller, Rochester, N. Y., chairman; F. S. Bronson, Geneva, N. Y., secretary.

Hornellsville, H. M. Bennet, Hornellsville, N. Y., chairman; C. M. Kelly, Hornellsville, N. Y., secretary.

Binghamton, J. B. Marquis, Jr., Norwich, N. Y., chairman; M. L. Sternberg, Lisle, N. Y., secretary.

Albany and Troy, W. L. Burke, Troy, N. Y., chairman; S. M. Strong, Schenectady, N. Y., secretary.

Jamestown, W. H. Homewood, Jamestown, N. Y., chairman; John H. Wright, Jamestown, N. Y., secretary.

Syracuse, F. M. Potter, Jr., Syracuse, N. Y., chairman; H. W. Fluhrer, Auburn, N. Y., secretary.

The Gas Turbine.

The gas turbine invented by Stolze has been described by Dr. Alfred Gradenwitz. The principle of this turbine is not new, as it was described by M. E. Redtenbacher in his treatise on the heat engine in 1853, and in 1872 Dr. Stolze showed how it might be applied in the fire turbine which he invented at that time. He was unable to obtain a patent covering his invention, and abandoned it temporarily; but when the steam turbine was brought forward so successfully, Dr. Stolze again presented his invention to the Prussian patent office, and a patent was granted. The principle employed is this: a certain quantity of air is drawn into a vessel and compressed to about one and one-half atmospheres above atmospheric pressure. It is then heated and allowed to expand at the same time, so as to maintain a constant pressure, until the volume has increased from two to two and one-half times. This air is then expanded further until it reaches atmospheric pressure, when it is discharged and the cycle repeated. To apply this cycle to a turbine, air is drawn in and compressed by means of a turbine driven as an air-compressor. This air is then passed through a reheater, which is heated by the exhaust gases. A small part of the air thus heated is used to maintain the combustion of the fuel employed, and the remainder is mixed with the heated products of combustion. This hot mixture is then allowed to expand through the turbine to atmospheric pressure. In the arrangement adopted there are ten discs in the air-compressor, and fifteen stages in the turbine. A calculation of the theoretical efficiency of the system shows that it may be as high as thirty per cent. By changing the cycle somewhat and allowing the gases to expand isothermally, an increase in efficiency is thought to be possible. The advantages of this turbine, as compared with a reciprocating gas engine, are the possibility of using any kind of fuel—coal, gas or oil; and the absence of water-jackets, which cause such great loss of heat in the reciprocating gas engine.—*L'Electricien (Paris), May* 6.

Telephone Apparatus for the War Department.

Brigadier-General A. W. Greely, chief signal officer of the United States Army, announces that on June 1, or as soon thereafter as possible, advertising for proposals for furnishing the signal corps of the army with telephone apparatus to the value of approximately $75,000 will be issued.

Models of practically all of this equipment may be seen in the signal corps model room, Washington, D. C., and drawings and specifications are under preparation. Representatives of manufacturers should call upon Major Edgar Russel, officer in charge of electrical division, Lemon Building, Washington, D. C., for permission to inspect the models.

American Institute of Electrical Engineers.

ASSOCIATES ELECTED APRIL 28, 1905.

Harry Louis Bachman, Columbus, Ohio.
Christopher G. S. Bagot, Worcester, Mass.
Edward Stuart Baker, Lynn, Mass.
Philippe F. Ballinger, Long Branch, N. J.
Edward Hugh Bangs, Indianapolis, Ind.
Magnus Beckman, Linköping, Sweden.
John T. Robb Bell, New York city.
James W. Brown, Connellsville, Pa.
J. S. St. George Cooper, Manchester, England.
Leonard P. Coulter, Milwaukee, Wis.
Isidor Deutsch, Cleveland, Ohio.
Horatio A. Dresbach, Jersey City, N. J.
E. W. Farley, Niagara Falls, N. Y.
Russell S. Feicht, Pittsburg, Pa.
Louis Friedmann, Chicago, Ill.
William R. Garton, Chicago, Ill.
George Gibbs, New York city.
Henry C. Harris, Columbus, Ohio.
Harvey Edgar Heller, Salamanca, N. Y.
Philip Edgar Henninger, New York city.
Henry A. Hildebrand, Brooklyn, N. Y.
Chester D. Hubbard, New London, Ct.
Fred L. Hunt, Schenectady, N. Y.
Herbert Chanock Jennison, Ansonia, Ct.
George Karl Kaiser, Wilkinsburg, Pa.
Matthew G. Kennedy, Philadelphia, Pa.
Walter E. Kern, Washington, D. C.
Frank Fairchild Kinney, Chicago, Ill.
Nathan Kohn, St. Louis, Mo.
J. A. Lauberstein, Great Barrington, Mass.
Alan C. Macdougall, Massena, N. Y.
Norman Malcolm, Chicago, Ill.
William B. Malloy, Great Barrington, Mass.
Louis J. Mathis, Newark, N. J.
Marshall Andrews Maxwell, Easton, Pa.
Charles Palmer Merrill, Washington, D. C.
Richard Gilbert Morle, Schenectady, N. Y.
Henry C. Meyer, Montclair, N. J.
Irving Heward Nevitt, Toronto, Ontario.
Coleman Evan Nutter, Topeka, Kan.
Hiroyoshi Oshima, Osaka, Japan.
Glover Fitzhugh Perin, Brooklyn, N. Y.
Thomas Steel Perkins, Wilkinsburg, Pa.
Frederick J. Pestell, New York city.
John M. Plaisted, Columbus, Ohio.
Frederick Hedge Poor, Schenectady, N. Y.
Thomas B. Reid, Great Barrington, Mass.
Charles Reutlinger, Baltimore, Md.
Harry Curtis Rice, Pittsfield, Mass.
W. Arthur Ruggles, Camden, N. J.
Fred William Schiller, Utica, N. Y.
William Arthur Scott, Pittsfield, Mass.
Paulding Foote Sellers, Buffalo, N. Y.
Thomas Gracen Seidell, Atlanta, Ga.
Joseph Emory Sirrine, Greenville, S. C.
Frank Whitney Smith, Brooklyn, N. Y.
Almon Beede Stetson, Malden, Mass.
Joseph Gordon Swain, Wilkinsburg, Pa.
Edward Taylor, Brooklyn, N. Y.
George La Rue Thompson, Philadelphia, Pa.
Wray Thompson Thorn, Chicago, Ill.
William Arthur Tower, Baltimore, Md.
Howard Mason Van Gelder, New York city.
Theodore Varney, Pittsburg, Pa.
William J. Walker, Brooklyn, N. Y.
Frederick C. Warman, Washington, D. C.
Karl William Waterson, Boston, Mass.
George Augustus Wells, New York city.
Frank Wenner, Ames, Iowa.
Gerard B. Werner, New York city.
Arthur S. Wheeler, Berkeley, Cal.
Leonard E. Wheeler, Great Barrington, Mass.
William A. Whittlesey, Jr., Pittsfield, Mass.
Brent Wiley, Cleveland, Ohio.
Joseph L. Woodbridge, Philadelphia, Pa.
H. W. Young, Boston, Mass.

Paxtang Power Plant Unharmed by Explosion.

On May 11, the day of the disastrous Harrisburg (Pa.) train wreck, the following telegrams were exchanged:

F. W. HAMBLIN, General Manager,
Paxtang Electric Company,
Harrisburg, Pa.

Papers report your plant badly damaged. Wire us if there is any way we can assist.

J. G. WHITE & COMPANY.

J. G. WHITE & COMPANY,
43 Exchange place, New York

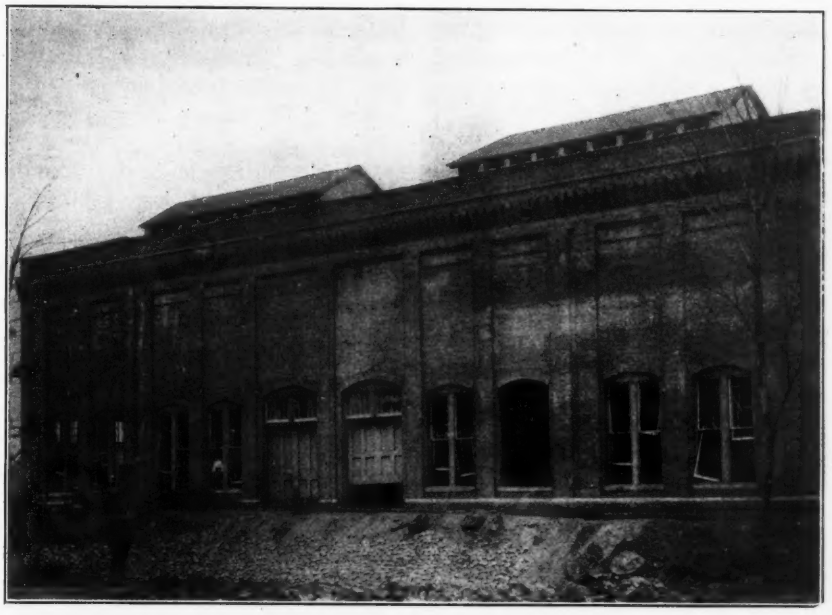
Thanks to substantial construction only damage all windows blown out. No interruption in service.

F. W. HAMBLIN.

It seems truly remarkable that none of the electrical machinery was in any way deranged despite the fact that when the two trains collided 50,000 pounds of dynamite exploded not more than 150 feet away from the power-house. The accompanying photograph of the power-house gives evidence of the force of the explosion. Hardly a pane of glass was left intact and even the window frames were blown in. A count showed that over 1,000 panes of glass were shattered, covering the engines, generators and machinery with finely broken glass. Graphic testimony that the operation of the plant was in no way affected is afforded by the accompanying reproduction of the voltmeter card for the twenty-four-hour period during which the explosion occurred. A momentary deviation of the pen, caused by the concussion, is the only irregularity on the card not traceable to operating conditions.

A careful examination has been made of the foundations, but no trace of damage can be discovered. Even if slight cracks should develop here and there, the foundations would still be perfectly waterproof as they are protected by hydrex felt which, being tough and elastic, would permit of considerable cracking of the foundation without itself rupturing.

The Paxtang power-house was designed, built and equipped by J. G. White & Company, and commenced operation in September, 1903. It contains one 300-kilowatt and four 500-kilowatt, two-phase generators, the power being used for lighting purposes. A transmission line carries the current from the main station to a substation located in the centre of the town, from which part of the power is distributed by the Edison direct-current system and the balance by two-phase alternating-current distribution.



POWER-HOUSE OF PAXTANG ELECTRIC COMPANY AFTER DYNAMITE EXPLOSION NEARBY.

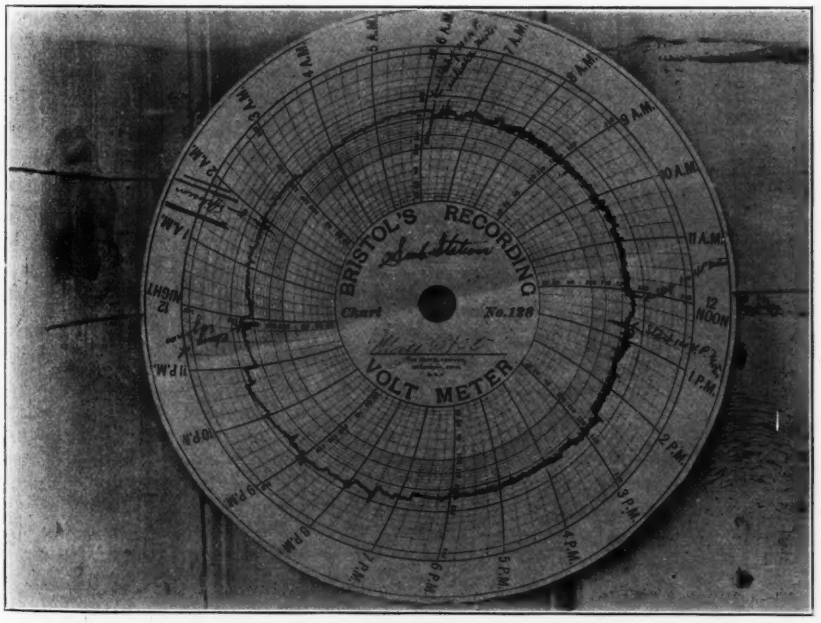
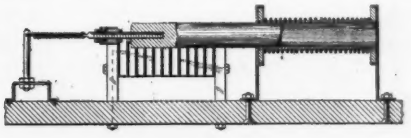


CHART SHOWING BEHAVIOR OF ELECTRICAL MACHINERY AT THE TIME OF DYNAMITE EXPLOSION OPPOSITE POWER STATION.

An Automatic Current Regulator.

A patent on an automatic electric current regulator has been recently granted to Thomas A. Swarts, of Columbus, Ohio (789,822, May 16, 1905). The object of the invention is to provide an improved current-regulating system adapted for use where the supply current is subject to variations. In the present invention, the system comprises a feed element and a potential regulating device having parallel series of contact points with the feed element connected to the contact point at one end of one of the series. A solenoid is connected to the corresponding contact of the other series. A core works in this solenoid and cooperates with the series of contact points. Means are provided for regulating changes in the load, this means having parallel series of contact points with a contact point of one series connected with the solenoid. A conductor leads away from a contact point of the opposite series. A solenoid is connected to the feed element and has a core working between and in cooperative relation with the second mentioned series of contact points.



AUTOMATIC ELECTRIC CURRENT REGULATOR.

PUBLICITY AS AN AID TO MANUFACTURERS.[1]

BY ARTHUR WARREN.

A department of publicity is a trade scout. It goes out in advance, a long way in advance, of the army of salesmen, and stirs up the possibilities of business.

* * *

When I talk of "publicity" let it be understood that I mean publicity in and for the industrial world, and that portion of the industrial world which concerns itself with engineering in many of the most important branches. Some kinds of business depend entirely upon publicity. They are businesses which cater for the populace. You can not compare their methods with the dissimilar and rather more scientific methods of an engineering company such as I have the honor to represent, a company which designs and produces both the great and the small in power engines, pumping engines, hoisting engines, blowing engines, steam turbines, hydraulic turbines, gas engines, air-compressors, electrical machinery, mining machinery, flour-mill machinery, sugar machinery, sawmill machinery, in brief a mechanical list which would measure a yard in length in nonpareil type.

* * *

Order is the first law of heaven and publicity. So we have to plan an effective system to get effective publicity. A good part of efficiency is promptness. And to be prompt you must plan ahead.

My notion of a department of publicity is that it is a sort of newspaper, and its management is not unlike that of a great newspaper. I had the good fortune to be brought up in a great newspaper establishment, under one of the ablest editors this country ever knew, and in publicity, my endeavor has been to combine the best newspaper methods with the best methods of the industrial world. How far short of this ideal the result falls no one knows so well as I, and, on the other hand, no one is more clearly aware of the difficulties in the path.

But difficulties exist in order that we may overcome them. When we have overcome them all we shall be ready to enter upon that state of perfect bliss where there is no more publicity.

* * *

Happily, those publishers who scorn publicity do not represent the most progressive element in the trade journal world. Happily, there are exceptions to the rule of mystery and dread: we know them, the men who have the courage to stand upon the merits of their journals. They are the men with whom we should do business; theirs are the papers we should seek. The stronger they are the better for our work. With such publishers a publicity department cooperates. We can help the live publishers and they can help us. They know it and we know it.

* * *

Publicity brings business. Manufacturers who do not buy publicity as liberally as they buy other selling facilities will some day have to take their places at the rear of the procession. The manufacturer who does not provide a publicity department of his own, small or large, and push it and develop it as he does any other branch of his business, is neglecting a great and profitable opportunity.

* * *

Everybody, once in a while, is curious regarding "follow-up-systems." I am trying to invent one. It is not perfect, but it has its good points. I have never known a perfect system, whether of "following-up" or of anything else. No system, whether it be of business, of government, or philosophy, is better than the men who work it. Most "follow-up-systems" are too complicated; they entail too much clerical labor. A "follow-up-system" that produces results without complexity is a good trade-getter. But it must be adapted to the special needs of a business. The reason so many systems break down is because they are imitations of what other people do. No system is effective without brains behind it. You must not only "follow up" your public, but you must follow up your system.

* * *

Don't take a narrow view of publicity. Don't swamp productive work with clerical work. A general in command can not fire the guns, can not count the ammunition used in battle, and can not tabulate the list of slain and of wounded—on the other side.

Advertising, whether direct or indirect, must be done generously if it is to bring results. The chief thing is to let the world know who you are, where you are, and what you are doing; and you can not do this on a large scale by stopping to take a census every time you fire a volley.

I am a believer in direct advertising, as well as in indirect; in the mailing list, as well as in the best trade journals. Each does what the other can not do. Each is essential.

* * *

A company's printed matter is a measure of the company's standing. It can not be too good. The best is the cheapest. Anything else puts you in a poor light. Tons of printed matter go out from all the advertisers in the country. Tons of it go straight to the waste basket. But the best of it finds its way to the customer's desk or bookshelf and is consulted when wanted. The best is not overdone and is never likely to be. The art of it all is to make your printed matter so good that the men you want to reach will always welcome it, and will always pick it out from the mass of matter that comes streaming in with each day's mail.

* * *

Publicity is an earning power. But the manifestations of this power have hardly yet begun. We have to make them so strong and fruitful that they will force themselves upon the attention of the manufacturing world in a way that even yet they have not done. There is so much more to do. We have to educate the manufacturing world to regard publicity as a revenue earner, not as a mere expense. Some manufacturers when hungry for business cut down their publicity expenses—cut down one of their means for making sales! When business is flourishing they say they do not need publicity; their shops are full of work. You remember the story of the Irishman's leaky roof. Pat couldn't mend the roof in rainy weather and on fine days it didn't need mending. Evidently we have some missionary work to do.

[1] Extracts from an address delivered before the Manufacturers' Advertising Club, Cleveland, Ohio, May 9.

Electrical Men Enjoy Planked Shad.

Mr. Charles E. Trump, president of the Novelty Electric Company, of Philadelphia, annually extends to several of his friends the compliments of a planked shad dinner during the season. The twelfth anniversary of this event was celebrated on Tuesday, May 16, at the Hon. W. H. Thompson's Park on the Delaware river near Philadelphia. The shad that were caught at 11 A. M. on that day were planked and served to the party at 1.30. Under these conditions, the king of fishes was at its best, and the shad this season are reported to be better than ever before and also scarcer.

Senator Thompson, the owner of the park and numerous electric railways connected with it, joined the dinner party before its adjournment and extended cordial welcome.

Among those present besides the host were Colonel Ezra De Forest, Captain W. L. Candee, George T. Manson, W. H. Hodgins, and Charles Cuttriss, of New York city; George P. Steel, of Williamsport, Pa., and E. B. Baker, of New Haven, Ct.

Before adjournment, it was unanimously voted to accept Mr. Trump's invitation for next year, the thirteenth, on which occasion proper cementing ceremonies will occur.

High-Speed Electric Railway Tests in Germany.

At the recent International Electrical Congress, held at Washington, Dr. Friedrich Schulz, president of the German Imperial Railway Commission, and president of the board of directors of the German High-Speed Electric Railway Society, presented an interesting paper giving the results of the noteworthy high-speed electric railway tests carried out at Berlin.

Dr. Schulz introduced his paper by referring to the early work of Dr. Werner von Siemens, who, it was said, in 1879 exhibited at the Berlin exposition the first practical electric locomotive. In the twenty-six years since that time the use of electric power has extended over the entire world, and the development in the United States has been extraordinarily great. As yet, however, electricity has not been applied for operating high-speed passenger railways. The question whether such an application could be carried out technically and profitably could be answered only through a practical test. To carry out this work, the High-Speed Electric Railway Society was founded in 1899, and in the four years following its work was completed. Financial support was given by the large industries and the banks; the German military department placed at the service of the society an experimental track, and the Prussian state railway supplied the material for constructing the way. During the many experiments made, velocities of 200 to 210 kilometres per hour (124 to 130.5 miles per hour) were reached—velocities which previously had only been approached.

For the experimental track the previous construction was maintained, but to prevent derailing and to strengthen the structure, light rails were laid between the others. The roadway was formed of rails twelve metres long, weighing forty-one kilogrammes per metre, each resting on eighteen wooden ties, the total weight being 224 kilogrammes per metre, including the guard rails. The sharpest curve had a radius of 2,000 metres, with an elevation of eighty millimetres of the outer rail. The grades were small. The experiments demonstrated that the present track construction is satisfactory for velocities up to 200 kilometres an hour.

Two motor cars were furnished, one by the Allgemeine Electricitäts-Gesellschaft, and the other by the Siemens & Halske Aktien Gesellschaft. They were of practically the same construction. Each car had room for fifty passengers. The cars were twenty-two metres long, with a distance between centres of the three-axle trucks of five metres. The weight was ninety tons. The cars ran smoothly at speeds of 200 kilometres per hour on the experimental track. The experiments demonstrated that the construction of the modern high-speed cars will be, in general, satisfactory for high velocities, if the wheel base be increased. By careful designing the weight might be decreased. In order to supply the large power required by the motors, a three-phase supply at 10,000 or 12,000 volts was adopted. The overhead conducting system consisted of three wires placed at the side of the track vertically, one over the other. The wires were of copper, 100 millimetres in diameter. They were supported on wooden poles by means of iron brackets. To the brackets was attached, for each wire, a safety device, which, in case of the breaking of a wire, disconnected the falling end from the supply, and the conductor automatically made contact with the grounded track. This apparatus gave good service in practice.

The Siemens & Halske collecting device, placed upon the roof of the car, was pressed, by means of light double springs, against the conductors. This apparatus also operated at the highest velocities safely and without pressing too heavily against the wires. It is thought that the experiments demonstrated how the large amount of energy required for high-speed cars may be supplied. At speeds of nearly sixty metres per second, with the car drawing almost 200 kilowatts, the conductors and the collecting device operated satisfactorily.

The transformer for lowering the high voltage to a lower voltage, for use in the motors, was placed under the car and worked well. The motors, which were designed for a normal output of 250 horse-power, could, when necessary, be called upon for 750 horse-power.

The air resistance increases much more quickly than the frictional resistance with increasing velocities, and the former therefore determines the limiting speed. The resistance of a trailing car is considerably less than that of a motor car; hence it follows that, for transportation of heavy traffic by means of quick and frequent single cars, a method ideal in some ways would require a much greater supply of power than the transportation in trains of several cars spaced at a greater distance apart.

The brake equipment consisted of the Westinghouse air brake and a hand brake.

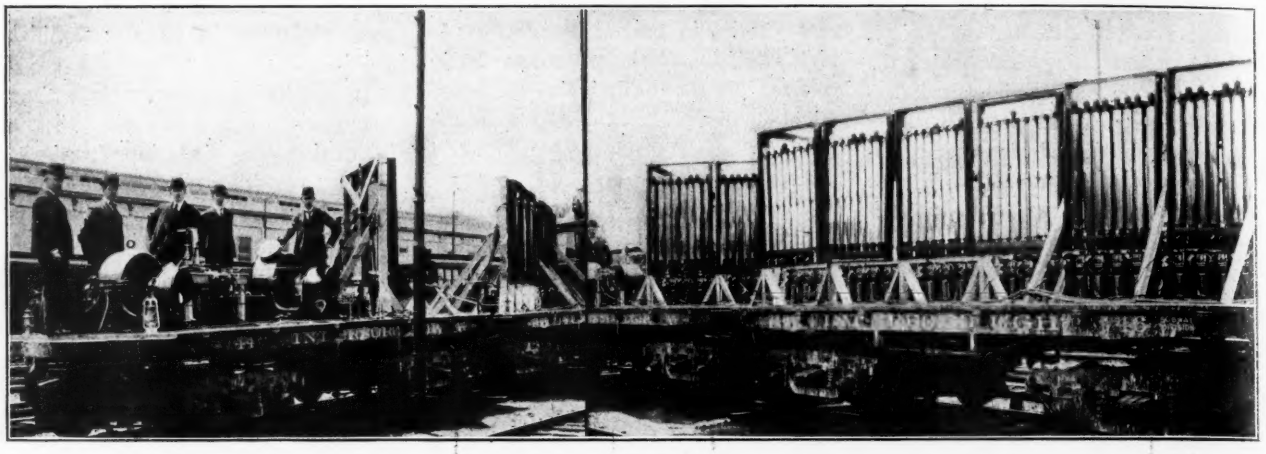
The visual signals were not clear enough in foggy weather at velocities of over 120 kilometres an hour. For this reason an electromagnetic device was placed in the motor car, which, by means of a rubbing contact, showed a red disc if the distant signal were set at "stop." This arrangement performed its office at the highest speeds.

In conclusion, a few general remarks were made. As was true when the steam locomotive was first introduced, some anxiety was felt as to the effect of the high speeds on the health of the passengers. Bearing upon this question is the experience of the test crew, who felt no inconvenience at speeds of 200 kilometres per hour and more. Each engineer stood at his post and made the observations assigned to him. The only noise interrupting the quiet in the car was the clock signal, which was sounded every ten seconds, at which time the readings and measurements were taken. The greatest strain came upon the engineer running the car, who had to attend to the operation of his car and watch the signals with the greatest care. Although surrounded by apparatus and wires carrying currents at voltages of 14,000 volts, those who took part in the test felt perfectly safe. In spite of a few bad short-circuits, none of the passengers were injured. Although one could survey the road comfortably during the journey, it was hardly possible to recognize a person standing on the platforms of the stations passed. The air-brake never failed to work, allowing the car to run over on to the adjacent state railway. No accidents were caused to any persons on the road. In all, over 300 experimental runs were made without a single accident. Not a single person was killed or injured. Not infrequently bloody impressions of small birds were found on the front of the car. The poor little creatures thought they could cross the way in front of the approaching vehicle, but the electric car was quicker than the flight of the birds and killed them. These were the only accidents which occurred.

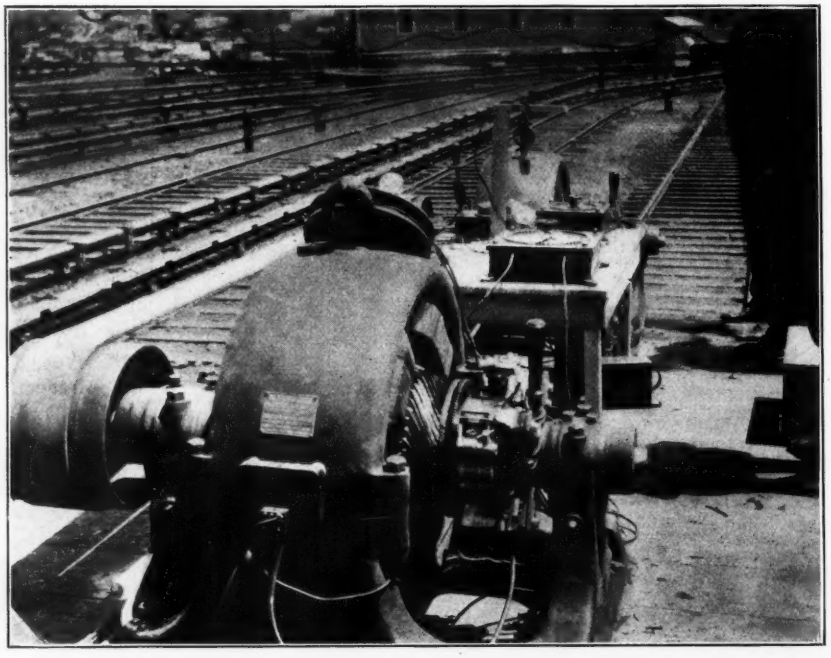
The society has thus accomplished its purpose. The conditions under which high-speed electric operation on main lines may be made are determined. Such operation brings no greater danger than operation by steam. Electrotechnics have thus opened a wide field for railway progress. The time may not be distant when a great operating high-speed electric railway will be called into life.

Taking Moving Pictures in the Subway.

On the morning of May 21 the American Mutoscope and Biograph Company, New York city, made elaborate preparations for taking a series of moving pictures of the subway of the Interborough Rapid Transit Company, from Fourteenth street to Forty-second street. This included scenes at the stations as the passengers left and boarded a local passenger train just ahead of the camera with which the pictures were made. The interesting feature of the expedition was the use to which Cooper Hewitt mercury vapor arc lamps were put. Upon two flat cars supplied by the Interborough Rapid Transit Company the American Mutoscope and Biograph Company had mounted, under the direction of Mr. F. A. Dobson, electrician, a complete generating outfit and nine banks of eight forty-five-inch type K mercury vapor lamps. The banks of lamps were staggered and arranged diagonally across the forward flat car, so that the light was thrown to one side and immediately ahead of the car upon which the camera was mounted. The car upon which the camera was mounted proceeded on the uptown local track. The flat cars containing the generating apparatus and the mercury vapor lamps proceeded at an even rate of speed on the uptown express tracks immediately to the left of the local. Each lamp was placed directly in front of a polished metal reflector. The lamps were started by means of the well-known kicking coil, the coils being arranged along the bottom of the frame. These may be seen clearly in the illustration.



TWO VIEWS OF THE FLAT CARS, SHOWING THE GENERATING PLANT, AND THE NINE BANKS OF EIGHT COOPER HEWITT MERCURY VAPOR LAMPS; A TOTAL OF 52,500 CANDLE-POWER.



THE GENERATING PLANT FOR SUPPLYING CURRENT FOR THE MERCURY VAPOR LAMPS.

The generating apparatus included a forty-horse-power, 600-volt Westinghouse motor, taking current from the third rail, and belted to a 110-volt, twenty-two and one-half-kilowatt, four-pole Westinghouse generator. Between the generator and motor there was set up a convenient switch table, upon which were mounted switches, voltmeter, ammeter, field control switch, and alongside of the table was arranged the field rheostat.

The banks of lamps are coupled together with fibre couplings. These are so arranged that the lamp banks may be thrown forward or backward, and connectors be put in between the various couplings. The whole arrangement was so adjusted that it could be dismantled within one hour.

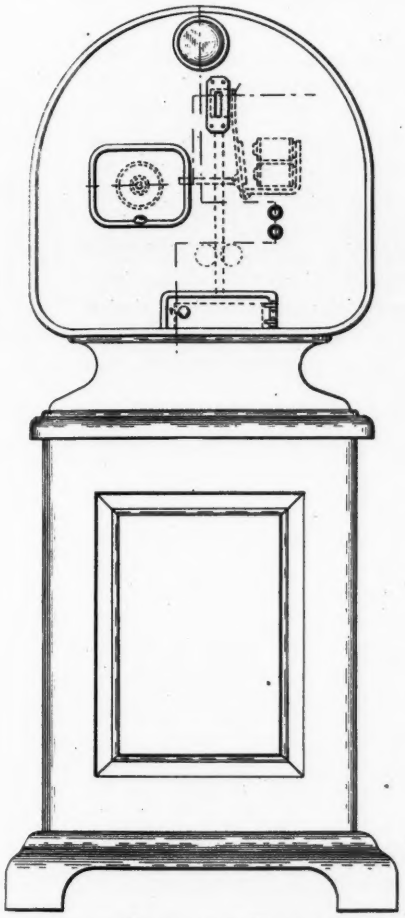
The brilliant light made by the 52,500 candle-power of illumination could be seen far down the subway. During the entire trip but one lamp went out. It was announced that the work was entirely successful, the details of the subway construction being brought out with remarkable distinctness by the high actinic power of the lamps.

Mrs. McFarland's Death.

The friends of Mr. Walter M. McFarland, acting vice-president of the Westinghouse Electric and Manufacturing Company, have learned with regret of the death of his mother, Mrs. Sarah J. McFarland, in Pittsburg, May 11. Interment was at Washington, D. C., Mrs. McFarland's home for more than fifty years prior to her Pittsburg residence of the past six years. She was seventy-three years old.

Electrical Patents.

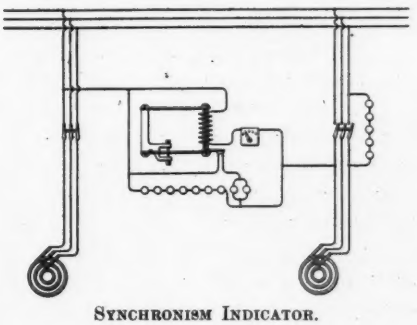
A charging station for electrically propelled vehicles has been patented by Frank P. Cox and Charles E. Holmes, of Lynn, Mass., and assigned by them to the General Electric Company, of New York (789,411, May 9, 1905). It is the object of the invention to provide a simple organization which will be cheap to in-



CHARGING STATION FOR ELECTRICALLY OPERATED VEHICLES.

stall, the current-measuring devices being located at the distributing station. Such a type of charging station may be employed in many cases where it is feasible to run a separate circuit or wire from a station to a convenient point which may be a rendezvous for cabs, as a theatre, hotel, or cab stand. Devices of this character are known in the art as "electrants" and are designed to permit the delivery of electric energy in determinating quantities upon the payment of a coin of defined value or by a deposit of a special token sold by the supply company. The invention comprises a type of electrant in which a storage battery vehicle in which there is a residual charge of current may gain access to a charging current and no other. The charging plug or station is provided with a coin-chute normally inaccessible, so as to prevent the insertion of strings, wires, twigs, or other fraudulent devices, but adapted to be rendered accessible by the charging plug of the automobile by means of an electromagnet controlled by the residual charge of the battery. The deposit of a coin then transmits a signal to central station indicating that a vehicle is present at charging station and the coin has been deposited. By the closure of a switch by the central station operator full potential is thrown on the supply wires to the charging station through a meter at the central station and after the value of the coin in current has been delivered the switch at the supply station is opened. An electric lamp is also provided in the charging post by which the cabman is apprised of the fact that his signal has been transmitted to the central station and which will indicate when the paid amount of energy has been put into his battery. Means are also provided for preventing the transmission of a signal to the central station except when a coin has been deposited in the chute. The invention, therefore, in brief, comprises a charging station for storage batteries provided with means under the control of the central station operator for delivering energy and fixing its quantity and means for indicating to the operator when the prepayment has been made.

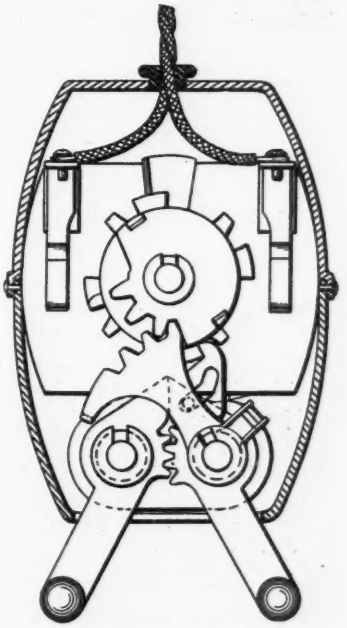
Paul L. Clark, of Chicago, Ill., is the inventor of a synchronism-indicator, which he has assigned to the General Electric Company, of New York (789,488, May 9, 1905). The invention relates to devices for indicating the proper instant for closing the line switch of an alternat-



SYNCHRONISM INDICATOR.

ing-current generator, synchronous motor, or rotary converter, which is to be connected in parallel with another similar machine already in operation. It is understood that this is to be done when the machines are in step, but under ordinary conditions it is uncertain when this instant occurs. The machines are never thrown together when the indicating lamps are fluctuating with short beats, and as the beats grow longer the interval of darkness or brightness extends over so long a period that it is difficult to guess just the right instant to close the switch. This invention aims to eliminate any possible doubt on this score, and it consists in a signaling device, such an an indicating lamp controlled by a switch, which is kept open so long as the phase displacement is at a maximum and is closed by a solenoid only when the beats become very long and at the middle portion only of each beat.

Hart & Hegeman Manufacturing Company, of Hartford, Ct., is the owner of a patent recently granted to Monroe Guett, of the same place, on an improvement in electric snap switches (789, May 9, 1905). The invention is particularly



ELECTRIC SNAP SWITCH.

adapted for use in pendent switches. The invention comprises an insulating base having stationary contacts mounted thereon. A spindle is supported by the base, and on this spindle is rotatably mounted a switch plate which is adapted for cooperation with the contacts. An oscillating member having spring detents which engage the switch plate for forward movement is employed. Stops are arranged on the switch plate, and are normally engaged by the finger of a pivoted plate, which plate is slotted to receive a pin carried by a lever, the lever and pin being adapted to disengage the plate from the stop. An arm is connected to the lever through a spring and to the oscillating member. The arm carries a pawl which is adapted to limit the movement of the switch plate.

Reviews of Current Engineering and Scientific Literature.

Heat-Conducting Insulating Varnishes.

In this communication Mr. H. W. Turner describes briefly researches carried out by him for a German manufacturing company, in order to develop and improve a method of insulating armature and field windings. The work was done during the years 1900 and 1901, and the insulating compound known as "electro-enamel" was produced. It was found that this material greatly decreased the temperature rise of coils on which it was employed. It also preserved the copper covering from deterioration at high temperatures, and rendered the coils thoroughly moisture-proof. It was found that if two otherwise identical coils, one of which was impregnated with this compound, were connected in series, a current sufficient to heat the wire to a dull red failed to affect prejudicially the impregnated coil after an application of forty-five minutes, while the untreated coil was destroyed within ten minutes, the cotton covering being charred completely away. It was pointed out that the value of an insulating covering can not be determined by means of a thermometer applied to the exterior surface of the coil, for this test simply gives the temperature of the outside, which will be less if the insulating material be a poor conductor, although the temperature within will be higher. Some curves are given showing comparative results of coils mounted in the same way, except that the wire of one is drawn through a bath of "electro-enamel" during the winding process. After passing a heavy current through two coils for 200 minutes, the temperature calculated from resistance measurements of the unimpregnated coil was 300 degrees centigrade; that of the impregnated coil was 255 degrees centigrade. The temperature of the two coils continued to rise, though at a less rate for the latter coil.—*Abstracted from the Electrician (London), May 5.*

Thermit Rail Joints.

A discussion of various methods of making rail joints is here given by Mr. G. E. Pellisier, special attention being drawn to the use of thermit. The complete outfit for making such a joint consists of a crucible, a pair of moulds made to fit the section of the rail to be welded, a pair of clamps to hold the moulds in place, a wire brush to clean off the dirt from the ends of the rails, a small gasoline torch to dry off any moisture which may be present on the parts to be welded, and a portion of thermit weighing from fifteen to twenty-five pounds, depending on the section of rail to be welded. The whole outfit may be transported easily in an ordinary wheel-barrow. In making a weld, the ends of the rail are first cleaned with the wire brush, which is done simply to remove the dirt. Rust makes no difference. They are then heated with the torch to drive off moisture, and are brought into exact alignment. The moulds are put in place and fastened, care being taken that they fit closely where they join each other and around the rail. All joints are made tight with moist clay and the top of the rail is painted with a thin paste of clay and water, which, when dry, prevents the slag and iron from adhering to the top of the rail. When desired, clamps are adjusted for upsetting the rail, but this is not at all necessary. Sand is next packed around the moulds, and the crucible set on a tripod above. The charge is placed in the crucible, and a small quantity of ignition powder laid on top. The latter is ignited with an ordinary storm match, after which the reaction takes place rapidly and furiously. In about twenty seconds boiling has ceased, and the iron separates from the slag. The former is then allowed to flow into the mould, and in less than one minute from the time the match was lighted the joint is made. After cooling, two or three taps of a hammer separate the slag from the joint, and the work is completed, no chipping or grinding being necessary except when welding old rails where the joints are battered. A welding gang consists of four men, and they can make twenty joints in a day of ten hours. No skilled labor is necessary. A one-mile section of a single track on the main street in Holyoke, Mass., has been welded in this way by the author. The gang consisted of three men working under his supervision. From eight to fifteen joints were made per day, the smaller number being due to the slow laying of the rails. The cost of these joints is estimated at $6 each. While the author is not ready to say that joints made in this way are better than cast welds or electrically welded joints, he thinks that the thermit process is much superior because of the inexpensive apparatus required and the simplicity of the process. Chemical analyses of the joint showed it to be practically identical with the steel rail. Mechanical tests showed the joint to be stronger than the rest of the rail, while the electrical contact was perfect.—*Abstracted from the Journal of the Worcester Polytechnic Institute (Worcester), May.*

Considerations Relating to the Design of the Armature Slot Insulation in High-Voltage, Alternating-Current Generators.

An investigation was made recently by Mr. H. M. Hobart of a number of alternating-current dynamos of various sizes, manufactured by firms in different countries, and from the data collected a curve has been plotted showing the average thicknesses of slot insulation for different voltages. This curve gives thicknesses of insulation less than those recommended by Mr. H. F. Parshall in 1901. As a starting point in the further consideration of slot insulation, a curve is drawn from the mean values of the curve and Parshall's. Comparing this curve with one showing the disruptive strength of natural mica for different thicknesses, it is found that, while the specific disruptive strength of mica increases with decreasing thickness, in generators it is customary to permit an increasing specific stress with increasing thickness of insulation. One explanation of this is that, for mechanical reasons, it is not safe to go below one millimetre for the thickness of the slot insulation, and this has accustomed us to the use of a high factor of safety in low-voltage machines. For high-voltage machines a virtue is made of necessity, and while one would gladly have a factor of safety of five at least in high-tension alternators, the cost makes this prohibitive. In building a machine, high-tension tests should be made at every stage of construction, mitigating their severity as the machine approaches completion; but at no time should the insulation be harmfully strained, nor the stress carried beyond two-thirds of the ultimate disruptive strength of the insulating material. From recent researches made by Dr. B. Walter, the conclusion is reached that, for a homogeneous material, the true disruptive strength is directly proportional to the thickness—that is to say, the specific disruptive strength is a constant for a given quality of a given material. From this conclusion a curve is plotted showing the ultimate dielectric strength required per millimetre for slot

insulation, allowing a higher factor of safety for low-voltage machines than for high. The author then discusses the properties of "reconstructed mica," and concludes that it is not safe to assume that the disruptive strength is higher than 20,000 root mean square volts. Arnold has given results which show the values of the dielectric stress which for various thicknesses of reconstructed mica set up a perceptible heating if continuously applied. It must not be concluded, however, that heating exists at normal voltage, due to dielectric stress, nor is heating due to dielectric stress necessarily not permissible during normal operation. While such heating introduces a loss, and is objectionable from this standpoint, as long as the ultimate temperature rise in the insulation due to all losses in the machine does not injure the insulation or exceed the guarantee, the presence of such dielectric loss should not necessarily be grounds for condemning a design. The following rough rule is given: if, for a given thickness, a certain voltage is just sufficient to produce perceptible heating, there will be one-half degree centigrade rise for every one per cent increase in voltage. This rule gives a value of the temperature rise too low for considerable thicknesses, and too high for thin insulation. It is suggested that exhaustive investigations be made into the relative values of different insulating materials; and these tests should not be made with flat surfaces only, but with the insulation bent around a curved surface as well. Different curvatures should be used, and the results plotted so as to enable the effect of curvature on disruptive strength to be determined. The necessity of drying thoroughly all insulating material is emphasized. Vacuum-drying ovens should be regarded as indispensable accessories in a factory where electrical machinery is built. Mr. Hobart agrees with the recent suggestion of Mr. Highfield, that the whole of the space from copper to iron in electrical machinery should be filled with insulating material, so as entirely to exclude air. Tests should also be made to determine the influence of ozone and acid fumes when acting for a long time. Aging tests should be made under various temperature conditions, as well as under the influence of cyclic changes of temperature. It is useless to attempt to draw any final conclusions from other than the most exhaustive tests. A great many of these could be carried out satisfactorily by students.—*Abstracted from the Electrical Review (London), April 28 and May 5.*

Electricity in the "City of the Holy Cross," Cal.

Santa Cruz, Cal., is an interesting city of about 10,000 inhabitants—interesting for a number of reasons, but particularly so electrically because, although it is comparatively small, there are six companies furnishing its electrical supply: the street and municipal building lights are furnished by a steam-driven city plant; the Cooperative Electric Company maintains a steam-driven electric plant for isolated and general service at the Casino, a famous recreation pavilion; the Big Creek Power Company, from the electric power transmission service rendered from its water-power plant in the Santa Cruz mountains and its steam-driven plant in Watsonville, supplies current for operating the electric circuits of the Santa Cruz Gas and Electric Company; and there are two competing railway systems occupying the streets of the city. The latter three companies buy power from the Big Creek Power Company. This company derives its power from two streams. The original development was located on Big Creek, which was believed to be capable of delivering a minimum of 1,000 horse-power throughout the year. The normal flow of the creek, without storage, was such as to make it inadvisable to rely on a minimum in excess of 500 horse-power, so two years ago this development was reenforced by diverting into Big Creek the flow of Mill Creek, which, in conjunction with its storage system, was planned for a continuous delivery of 2,000 horse-power to the plant. In both cases water is impounded by means of crib dams. The topographic formation of the country is such that Big Creek flows down one side of a back-bone ridge, the other side of which forms a cañon through which Mill Creek flows. In these cañons are the ditches for the two systems, which unite at the junction of the creeks at the end of the ridge, shortly below which the power-house is located. These flumes are covered throughout their whole length, keeping out the leaves and other debris. The power-house is a comparatively small structure located at the foot of the pipe line on the westerly bank of Big Creek. Its equipment consists of two 1,500-kilowatt, two-phase, 1,100-volt, sixty-cycle generators driven by a 500-horse-power, forty-six-inch Pelton wheel. There is also a fifty-four-inch Pelton wheel driving one 400-kilowatt and one 180-kilowatt two-phase, 1,100-volt, sixty-cycle generators. The exciting equipment consists of a two-inch Pelton wheel driving one eleven and one-half-kilowatt and two six-kilowatt, 125-volt exciters, all direct-coupled. The pole line consists of redwood poles cut down in the neighborhood. There are two transmission lines from the power-house to Santa Cruz. One passes along the coast, and was the first to be erected. It gave considerable trouble, due to the fogs and salt spray from the ocean, so that it was supplemented by a second line which is carried through the country back of the coast. It was on the coast line that the fog boxes were first tried and found successful. The Watsonville plant receives power from the Big Creek Power Company. It has also a complete steam plant, which has been installed to supply the business of the company beyond the capacity of the water-power station. It serves also as a reserve in case of interruption to the transmission service. This plant uses oil fuel, which is stored in a 500-barrel cement tank set in the ground in the rear of the station. The oil is burned under Babcock & Wilcox boilers of the vertical header type. Steam is used in a horizontal engine, which is direct-connected to a 750-kilowatt, 11,000-volt, sixty-cycle, three-phase alternator of the revolving-field type. The Cooperative Electric Company's plant consists of two Babcock & Wilcox boilers supplying steam to a 300-horse-power Corliss engine, driving by means of a belt a 180-kilowatt, 3,300-volt, three-phase alternator. The municipal street lighting plant contains tubular boilers burning oil which furnish steam for the operation of a Corliss engine that, in turn, drives two sixty-five-light Brush arc dynamos and a centrifugal pump for handling sewage.—*Abstracted from the Journal of Electricity, Power and Gas (San Francisco), May.*

Electrical Manufacturing in Lancashire, England.

During the first two months of this year the electrical engineering firms of Lancashire, England, had, according to the *British Trade Review*, scarcely work enough to keep their shops fully going. Now, however, orders are becoming more plentiful, and there is every prospect of a busy summer. Numerous enquiries are received, both from England and from foreign countries. There is thought to be hardly any limit to the possibilities of electrical engineering, especially with regard to the supplying of power for manufacturing purposes and locomotives. A great development in the industry is anticipated, not only in Lancashire, but throughout the north of England, particularly in the driving of cotton mills and the running of other works.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

A New Single-Phase Alternating-Current Crane Motor.

Following the development of the single-phase, alternating-current railway motor and its successful adaptation to the conditions of modern traction service, the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., has placed upon the market a complete line of motors of similar characteristics but smaller capacity for the operation of electric cranes, hoists, elevators and similar apparatus demanding a heavy starting torque and a wide range of speed variation under control of the operator.

Like the alternating-current railway motors, these motors, designated as type SC, are of the series-wound commutator type, with compensating field windings, laminated cores and inwardly projecting poles. The fields consist of laminated cores built up of sheet-steel punchings held between end-plates and mounted within cast-iron frames. The frames are of the box type and are closed at the end by substantial brackets which support the bearings. Feet are provided for the convenient mounting of the motors. The bolts which hold the end-plates to the frame are evenly spaced, so that the bearings may be turned ninety degrees and the motor mounted upright or with the feet bolted to a vertical surface. The large opening around the commutator is closed by a sheet-steel band fastened by thumb screws and so arranged that easy access may be obtained to commutator and brush-holders at all points. The bearings consist of solid shells lined with babbitt metal, and are of ample dimensions for the most severe service. Grease lubrication is used, drip cups being provided under the bearings.

There are four inwardly projecting poles made of laminated steel, punched solid with the core, and magnetized by field coils of the usual type. An auxiliary field winding is also provided, threaded through slots in the pole-faces.

The armature is of the usual slotted drum type with core built up of circular punchings of soft sheet steel mounted upon a cast-iron spider. In the larger sizes ventilating ducts are provided between the punchings through which air is forced out against the field coils and core. A uniform temperature is thus maintained at all parts. The commutator is mounted upon an extension of the armature spider. Wiper rings are provided to protect the armature from grease. The shafts are of great strength and are extended at both ends to accommodate pulleys, pinions and brake discs.

The carbon-holders are the same as the standard Westinghouse holders which have been so successful in direct-current practice, and consist of rectangular boxes machined to fit the brushes. An even pressure is maintained by the long, flat spiral spring, while the smaller vibrations are taken up by a short spring.

Type SC motors are wound for a nominal potential of 200 volts, at 3,000 alternations, or 100 volts, at 7,200 alternations per minute, but will operate successfully upon voltages ten per cent higher. For other potentials it is advisable to use transformers. These motors

NEW CRANE MOTOR.

are manufactured in sizes having nominal ratings from five to thirty-five horsepower and are wound for twenty-five cycles per second. For larger capacity, the standard single-phase, alternating-current railway motors are recommended.

The speed of motors of this type may be varied by any method which will vary the electromotive force impressed at the motor terminals. On account of its simplicity and effectiveness the rheostatic method of control, similar to that used with direct-current series-wound motors, has been adopted as standard. The controllers and resistances are similar to those used with direct-current motors of similar capacity and are of the well-known Westinghouse dial type or commutator type, according to the size of the motor with which they are to be used. Resistances are mounted in the controller frames. Contact fingers are carried on a moving part having four radial arms and can be operated by a single handle or a system of bell cranks and levers. The operating rod can be connected to either the right or left-hand side of the rocker arm, so that the controllers can be mounted face to face or back to back, as may be the most convenient. A single movement forward or back applies the current for the operation of the motor in either forward or reverse direction. Controllers of the dial type have twelve steps, those of the commutator type sixteen steps in either direction. The great number of steps reduces sparking at the contacts. Contact segments and fingers may be easily renewed. With the smaller controller the resistance is formed of wire wound with insulated bars which are supported in the frame by porcelain blocks. With the large controllers, resistances of the grid type are employed.

These controllers differ from those used with direct-current motors mainly in that blow-out magnets are not used. As the circuit is broken at four points, arcing is reduced to a minimum. At the first notch of the controller all contacts make connection simultaneously, with a maximum resistance in circuit. Succeeding steps are made by one set of fingers at a time. The large number of steps employed makes possible a very exact speed control, with a smooth start and a gradual acceleration, and reduces the starting current to a minimum.

All parts are easily accessible and the entire mechanism is simple and easily operated and maintained.

For use with type SC motors a complete line of automatic electric brakes, similar to those employed with direct-current series-wound motors and with induction motors in crane and hoisting service, has been developed. The device consists of a set of brake shoes, levers and magnet coils which are mounted upon the front end bracket of the motor, and a brake wheel which is mounted on the motor shaft. The shoes are lined with a special composition and are supplied to the wheel by the action of the armature of an electromagnet. A turnbuckle adjustment provides means for taking up wear. The electromagnet consists of a

U-shaped core and a U-shaped armature with two windings—one around each limb. Electrical connections are made across the line through a switch on the controller. The switch is automatically operated with the first step of the controller. When closed, the armature of the electromagnet is raised and the brake released. When movement of the controller to the off position opens the switch, the armature of the electromagnet falls under the action of gravity and the brake is set. The armature is connected with the brake shoe by means of links in such a way that it is practically impossible for the brake to fail when the controller is in the off position. Should the power fail while the motor is operating, the brake is immediately set and the load held. As both brake and controller are operated by the same mechanism, it is impossible to set the brake while the motor is connected to the line.

Electric Ventilating Fans.

The Crocker-Wheeler Company, Ampere, N. J., is applying electric motors to ventilating fans, as shown in the accompanying illustrations. Fig. 1 illustrates a Crocker-Wheeler motor connected to a twenty-four-inch Davidson fan. The smaller types of fans are operated by the bipolar form L motor. The larger sizes are equipped with the four-pole form I motor. The form L motors have cast-steel frames with two internally projecting poles, while the form I motors have cast-iron frames with steel poles cast welded to the frames. In both types the bearings are carried by end shields which are bolted to the frames, and are provided with oiling rings running in reservoirs. This feature enables the motors to be run a considerable length of time without attention. The frames and shields are so constructed that the motors are well protected from external injury. Ample provision is made, however, for ventilation.

The field coils are wound on forms heavily insulated and taped, and are made dust and moisture-proof. They are held in place on the poles by laminated shoes. The armature cores are built up of steel laminations slotted to receive the windings, and properly insulated from one another in order to reduce the eddy current loss to a minimum.

The commutator bars are of hard-drawn copper. They are of uniform section, and are insulated from one another by shell mica. The brush rigging is of simple and rigid construction, and requires no special attention.

Fig. 2 shows a Crocker-Wheeler type 51 motor direct-connected to a forty-two-inch Davidson propeller fan. The blades of the fan are of flanged steel, and are compound curved, being so designed as to pick up the air at a very low velocity and deliver it at a comparatively uniform pressure over the whole delivery surface of the fan. The blades are attached to a long cast-iron hub at two points This

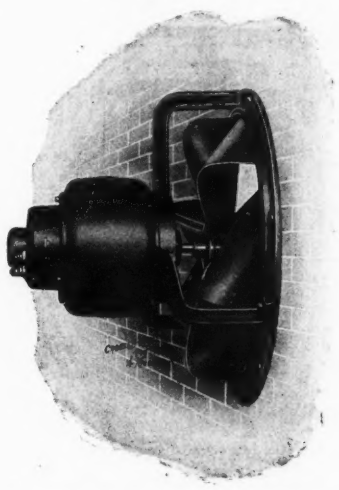


FIG. 1.—TWENTY-FOUR-INCH FAN WITH DIRECT-CONNECTED MOTOR.

serves to fix the pitch of the blades, which are set at an angle of forty-two degrees with the axis of the shaft. The outer rim of the blade is attached to a heavy wrought-iron running ring welded and made endless. This running ring is, in turn, connected to the outer end of the cast-iron hub by five steel braces, which

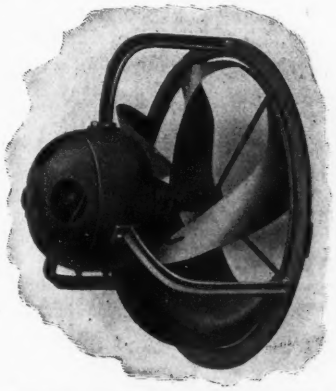


FIG. 2.—FORTY-TWO-INCH FAN WITH DIRECT-CONNECTED MOTOR.

are shouldered at their outer ends and riveted through the running ring. The inner ends are screwed into the hub. This construction ensures rigidity and safety to the fan at any speed, and enables it to be operated at very high peripheral speeds.

Fans which are used in drying-houses, bleacheries, sulphate mills, or in any other location where they are required to meet air or vapor containing gas which is likely to corrode steel blades, are furnished with blades of cold rolled copper or of composition.

The motors are furnished direct-connected to fans in all sizes from eighteen inches to sixty inches, inclusive. The motors may be open, gauze-enclosed, or fully enclosed, as the local conditions require. With the smaller sets the motors and fans are connected, a casting combining the wall ring and supporting arms being employed. With the larger sizes a separate wall ring is used, and this is fastened to the motor frame by means of iron arms. The former construction is illustrated in Fig. 1; the latter, in Fig. 2.

The motors are wound for either 115, 230 or 500 volts direct current, and are provided with a no-voltage release starter or a speed regulator capable of reducing the speed of the fan.

Bids Wanted—Water-Power Electric Plant.

Proposals will be received at the office of George W. Wagenseller, secretary, Middlecreek Electric Company, in Middleburg, Pa., up to noon of June 15, 1905, for the construction of a complete water-power electric plant of 700 horse-power, on Middlecreek and Pennscreek, two miles south of Selinsgrove, Pa. Bids can be made on part or all of the work.

The requirements are: a solid concrete dam, seventeen to twenty feet high and about 360 feet long; a tunnel and waterway 1,225 feet through a mountain; a power-house, two units with four wheels—direct-connected generators; auxiliary engine and boiler and complete equipment with twenty-five or thirty miles line construction, to furnish light, heat and power to Selinsgrove, Sunbury and Northumberland.

Plans and specifications can be seen at the office of the secretary in Middleburg, Pa., or at the office of E. F. Shatzer, hydraulic engineer, at the site, two miles south of Selinsgrove, where bidders can get the most satisfactory information. W. K. Darlington, Real Estate Trust Building, Philadelphia, is engineer.

Good Roads Convention.

The fifth annual National Good Roads Convention will be held in the auditorium at the Lewis and Clark Centennial Exposition, Portland, Ore., June 21-25. The proceedings of the convention will include addresses and discussions upon the scientific, eithic, and economic phases of the subject of good roads, and its relation to industrial progress and development.

New Type of Water-Tube Cleaner.

The General Specialty Company, Buffalo, N. Y., has brought out the "Demon" water-tube cleaner for removing the scale from the interior of the tubes of water-tube boilers. The machine consists essentially of two parts, namely, a new form of scale-cutting tool and a new and powerful form of motor to drive the cutter. The motor belongs to the general class of rotary engines, but differs from most of these in the essential feature that it has a central shaft, and is free from all valves. The maker states that it bears no resemblance to a turbine, either in design or in operation. The machine is operated by water power, and the exhaust water is used for washing away the loosened scale. The inlet and exhaust water is taken care of by properly arranged ports. The pistons of the motor, which are three in number, are attached to the shaft, and each, in turn, projects across the cylinder, forming a partition between the inlet and exhaust ports. The amount of water consumed is directly proportional to the speed at which the machine is revolving. When the machine is working on un-

"Demon" Tube-Cleaner.

usually heavy scale, the speed and the water consumption are both somewhat reduced.

The cutting tool is designed to cut the scale, in contradistinction to grinding it. Three cutters with tooth-shaped edges are attached to a heavy head, the latter being directly attached to the shaft of the cleaner. These cutters are journaled to the head at the front end, but slide in grooves at the rear end. They are not thrown out by centrifugal force, but are forced out by springs, so that they engage the scale in a positive manner. In order to prevent any possible injury to the tubes, and also to relieve the cutters of any friction and wear after the scale has been removed, the outward movement of the cutters is limited by a properly arranged stop. The cutters can be set so that their outside diameter is just equal to the inside diameter of the tube which is being cleaned. The motor or body of the cleaner is properly centered in the tube by six centering lugs, which ensure thorough and uniform work of the cutting tool on all sides of the tube.

Hubbell Pull Sockets.

Harvey Hubbell, Bridgeport, Ct., the well-known manufacturer of pull sockets, pull clusters and other electrical specialties, has moved the New York office to the new Barclay Building, 299 Broad-

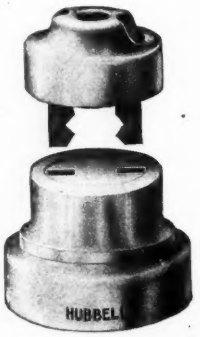


Fig. 1.—Side-Wall Pull Socket.

way, where samples of goods manufactured by this firm will be carried. The office will be under the direct charge of H. W. Bliven, sales manager of the firm. The line of attachment plugs manufactured by this company embodies several unique features.

The Hubbell plugs are all made with separable caps—that is, the plug is in two parts, cap and base. The contact in the entire line of Hubbell plugs is on the knife-blade principle. There are no electrical contacts exposed. Each terminal is enclosed in a separate cell. The caps of the Hubbell plugs are made of porcelain, hard rubber, and porcelain with brass cover.

Two of the plugs are illustrated herewith. They are the side-wall plug, shown in Fig. 1, and the current-tap,

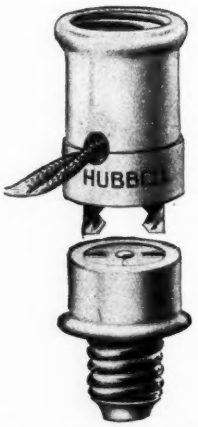


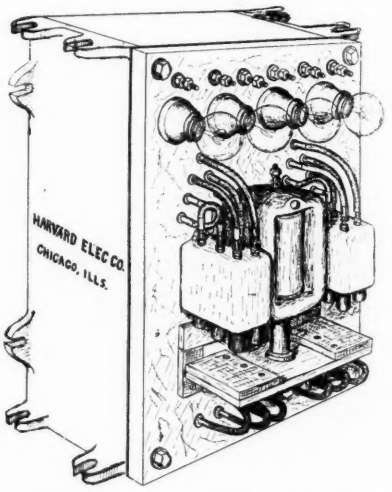
Fig. 2.—Current-Tap.

shown in Fig. 2. The side-wall plug can be used both with cleat and concealed wiring. It dispenses with socket and receptacle and can be used wherever it is desirable to use an extension cord. The current-tap is made on the same principle and is interchangeable with the entire line.

The new Trinity Building, at Thames street and Broadway, New York city, one of the most extensive and elaborate office buildings in the country to-day, has been equipped throughout with the Hubbell flush plugs.

An Automatic Electric Controller.

The Harvard Electric Company, Chicago, Ill., is placing on the market a line of automatic electric controllers. These controllers are simple in construction, durable, and of neat appearance. The illustration herewith shows the automatic motor-starter, which may be operated by a small snap switch or push-button placed at any distance from



Automatic Electric Controller.

the starter. These controllers automatically start the motor slowly with heavy loads, and more quickly with lighter loads, automatically returning to the starting position whenever there is an overload on the motor or when there is no voltage on the line. A feature of this device is that the contact surfaces increase as the motor is started, so that the motor runs with a large carbon contact.

The circuit is open on both sides, and the resistance is first cut in, and then the circuit is quickly broken between carbon and carbon. Besides these motor-starters the Harvard Electric Company is making a full line of automatic electric controllers, both single and reversing; single and reversing sign flashers; letter sign flashers; pressure regulators for electric pump service; electric controllers, and controllers for all forms of automatic electric service.

A New Oscillating Fan.

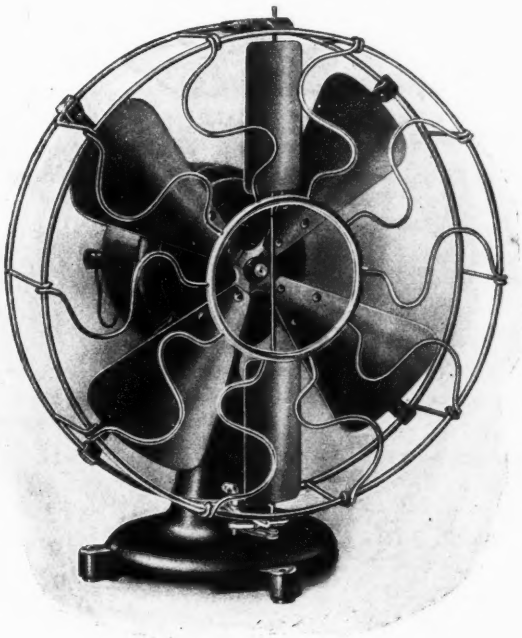
The accompanying illustration shows the new type "O. D." oscillating fan built by the Peerless Electric Company, Warren, Ohio. The Peerless oscillating fan represents a departure in this style of motor. The shifting vane which actuates the simple rotating mechanism is located inside the guard, removing any possibility of injury from external causes. The fan body rotates on double ball bearings, the balls, cones and races of which are made from high-grade steel, carefully hardened and ground.

The switch-plate, which is located in the base of the fan, is of steel, to withstand severe usage. On this plate is securely fastened the switch mechanism, mounted on heavy fibre board, all riveted together.

The brackets that support the actuating vane are rigidly fastened to the guard. These also carry the throwing lever.

Current is transmitted from the main circuit through the brush-holders to collector rings mounted on the hollow bearing spindle. Through this hollow spindle the leads to the motor are carried from the collector rings. By the use of collector rings there is no possibility of lead wires wearing off in consequence of the oscillating movement.

The switch, brush-holder and collector rings are entirely contained within the base of the fan, protecting these parts from dirt and injury. The standard finish of the guard and blades is brass.



New Oscillating Fan.

The Deutsch Electric Train-Lighting System.

The salient features of the Deutsch system of electric lighting for railway passenger cars are reliability of operation and low maintenance cost, the elimination of delicate moving parts, the simplification of electrical connections, and the provision of a direct-connected drive which allows the wheels to be easily changed. Inspection and repairs may be made without jacking up the car.

The Deutsch system consists of a dynamo hung in any convenient place in the car, a transmission gear, and the usual storage batteries. The storage battery is intended to supply current for the lights when the train is standing or running at less than a specified speed.

The drive consists of a steel bevel gear provided with a suitable hub extension forming a bearing immediately adjacent to the tooth face. The gear is attached to the axle and rotates with it. Encircling the bearing is a steel strap, to which a stud is electrically welded. This stud forms a bearing support for a raw-hide pinion which meshes with the steel gear, and to which is fastened the shaft for driving the dynamo. The shaft is telescopic, and provided with universal joints to allow for axle play and side motion of the truck on curves. Any tendency of the strap to revolve with the gear around the car axle is resisted by a rod projecting upward from the strap, and flexibly supported by the truck frame.

The steel gear casing is cast integral with the strap, thus making the gear casing, strap and pinion bearing in two pieces, which are bolted together and carried by the hub bearing of the gear. This arrangement ensures perfect alignment of the gear teeth under all conditions.

The advantages of this drive are stated by the maker to be as follows: it is not affected by snow, ice, sand, escaping steam or by tipping of the truck; the parts are simple, durable and of easy access; it has no sliding dust guards which may work loose and wear holes in the casing; there is no necessity for work to be done under the truck in changing wheels, as the whole transmission is supported by the car axle, and drops with it; no pivotal movements or springs are required, any inspection or repairs can be made without jacking up the car; there is practically no weight on the bearings of the transmission, and it is absolutely unaffected by shock from any cause, so long as the truck remains intact.

The dynamo is rigidly suspended under the car body. The bearings are self-aligning and ring-oiled. The wear on the bearings is insignificant, and the flexible nature of the shaft connection prevents any shock being transmitted to the dynamo. The armature can be removed and a new one substituted in about fifteen minutes. Both bearings are of the same size, and all screws holding removable parts are standard and of the same size. The casing can be removed, completely exposing the machine for inspection, in one minute by simply slacking two wing nuts, and the armature bushings can be removed without disturbing any electrical connections.

The regulator consists of an automatic switch, a controlling solenoid, an air valve, a cylinder, a piston working in the cylinder and carrying electrical contacts on the rod thereof, and a resistance located in the shunt-field circuit of the dynamo. The automatic switch cuts the dynamo in and out of the lamp circuit above and below a specified train speed—that is, when the train runs below a specified rate of speed, the lights are on the storage battery; above that speed they are on the dynamo. If the train speed is increased so that the dynamo is running faster than necessary for the maximum output, the controlling solenoid opens the air valve, thus raising the piston carrying the electrical contacts, and cuts resistance into the shunt-field circuit of the dynamo, thus reducing the output. When the train speed decreases, the air valve is closed by the controlling solenoid, and the piston drops by gravity, thus cutting resistance out of the field circuit until the dynamo output is again at its normal maximum. The regulator does not depend for its operation upon electrical means, being driven by compressed air from the brake mechanism. The working of the regulator is noiseless, and there is no motion except when the train speed materially changes. There are no rotating parts to cause trouble, and all electrical connections are simple and conveniently arranged.

The machines are furnished with all parts made to gauge and all corresponding parts interchangeable.

The Electric Controller and Supply Company, Cleveland, Ohio, is the licensee of the Deutsch patents for the United States, Canada and Mexico, and will supply any further information desired regarding the system.

Alternating-Current and Direct-Current Solenoids.

The accompanying illustrations show two new types of alternating-current and direct-current solenoids which have been

FIG. 1.—IRON-CLAD CLOSED-TYPE SOLENOID.

placed upon the market by the American Electric and Controller Company, 136 Liberty street, New York city. These solenoids may be used for the operation of switches at a distance, for the operation of motor starters, electric brakes as used on hoists, elevators and conveying machinery. The solenoids may also be used

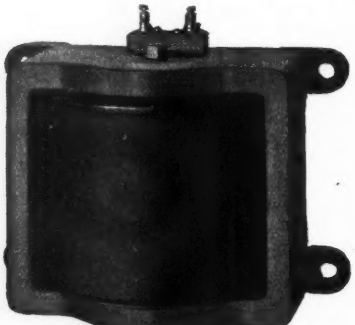


FIG. 2.—OPEN-TYPE SOLENOID

to operate valves from remote points by push-button control. Automatic control may be installed where desired. Fig. 1 shows the new type iron-clad solenoid, and Fig. 2 the open-type solenoid.

Automatic Release Starters and Motors for Heavy Duty.

Among the recent large orders received by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is one covering two 1,500-horse-power, 250-volt automatic release starters for use in the Edgar Thompson steel works of the Carnegie Steel Company, Braddock, Pa. These starters are particularly interesting, not only for their size, but on account of the general arrangement of the starter, the unique type of resistance used, and the large overload capacity of the equipment.

The starter proper will be built in the form of a switchboard of white Italian marble, approximately seven feet eight inches high and eleven feet long. The starter parts will be of the well-known type used by the Cutler-Hammer Manufacturing Company, where the several sections of starting resistance are controlled by a number of independent levers. For the starter in question, the levers which will carry the motor current continuously are to have a continuous capacity of 10,000 amperes, and are guaranteed to carry this amount with a temperature rise not exceeding forty degrees centigrade. The intermediate starting levers, which as occasion demands, may also be used temporarily for regulating duty, will have 6,000 amperes capacity on the same basis.

The switchboard will consist of five panels, each panel containing two levers. The connection between the different panels will be made at the rear of the switchboard by bus-bars in the usual manner. At the front of the switchboard, such arrangements will be made that with very little trouble an entire panel may be removed from the board without disturbing the other panels, or the parts mounted on them. The levers on the several panels are mechanically interlocked in the manner adopted for the multiple-switch type of starters, so that the several levers composing the starter can not be operated except in a predetermined order.

The resistance for these starters will consist of standard steel rails, mounted in a steel rack, approximately twenty feet high, fourteen feet wide and twenty-seven feet long. There will be about 100 twenty-five-pound rails and 200 forty-pound rails used. This great capacity of resistance material is provided so that the resistance may be used to control the speed of the motor for short periods of time, even under comparatively heavy loads without permanent injury. The main connections to the starter will consist of six 1,000,000-circular-mil cables, while the intermediate resistance leads will consist of four 1,000,000-circular-mil cables.

The motors which these starters will be used to control are of Westinghouse make, and will be very heavily compounded. The motor armature shaft will carry a flywheel twenty feet in diameter, weighing approximately 125,000 pounds, and will be directly connected to the standard blooming mill rolls. The motors will be designed to stand very heavy overloads for short periods of time, and mechanically constructed so as to stand the strains encountered in this service. The normal speed of the motor will be 100 revolutions per minute, and allowances will be made so that this speed may be increased twenty-five per cent by weakening the shunt field of the motor. If the installation of these motors proves satisfactory, which result is confidently expected, the Carnegie Steel Company will equip the mills in its other plants with motors instead of the cumbersome steam engine now used.

For some time the Pittsburg Reduction Company has had a 1,500-horse-power, 500-volt motor driving a blooming mill in satisfactory operation at its plant at Massena, N. Y., which is controlled by a 500-volt starter, similar in construction to those to be installed at Braddock. Since installation, this particular equipment has given every satisfaction, and it would now seem as if the motor-drive was considered perfectly feasible for the largest mills.

New Arrangement in the Sales Organization of the Westinghouse Machine Company.

The Westinghouse Machine Company has recently announced substantial extensions in its sales organization. These extensions are the result of the rapidly increasing business, making necessary the more thorough covering of southern and western territories.

In addition to the original New York, Boston, Pittsburg and Chicago offices, new branches have been established at Cincinnati, Denver, San Francisco, Charlotte, N. C., and Atlanta, Ga. With these added facilities the extensive mining territory of the West and cotton industries of the South may receive more active attention.

The steam turbine and gas engine business of the company has increased rapidly during the last few years, and the prevailing activity in this branch of power development augurs well for the future.

The representative offices of the company are now as follows: New York, 10 Bridge street, L. L. Brinsmade; Boston, 131 State street, E. L. Clarke; Pittsburg, Westinghouse Building, William Bradford; Chicago, 171 La Salle street, John B. Allan; Cincinnati, 1111 Traction Building, A. A. Brown; Denver, 512 McPhee Building, C. C. Chappelle; Charlotte, N. C., South Tryon street, Stuart W. Cramer; Atlanta, Ga., Equitable Building, Stuart W. Cramer; Philadelphia, Stephen Girard Building, R. Muckle, Jr. & Company; San Francisco, 614 Mission street, Hunt, Mirk & Company.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

PORTLAND STREET RAILWAYS SOLD—The Portland Consolidated Street Railway Company, which operates all the street railways in Portland, Ore., has been purchased by a syndicate composed of Pennsylvania capitalists. The price was $5,000,000.

PROPOSED POWER PLANT IN OREGON—A town site is being developed near the falls of Hood river by W. Ross Winans. He proposes to construct a series of dams along the river, by which 50,000 horse-power may be developed. Power will be transmitted to points in the valley to supply the various towns with electric light.

CONSOLIDATION OF LIGHTING COMPANIES IN SOUTH DAKOTA—A merger of the Lead and the Deadwood electric light companies has been effected. The new company will install a power plant at Pluma, which will be one of the largest in the West. The plant will cost $10,000,000, including machinery and the transmission lines.

EXTENSION OF THE EDISON SAULT ELECTRIC COMPANY—The Edison Sault Electric Company, of Sault Ste. Marie, Mich., has filed a mortgage for $500,000, in favor of the Central Trust Company, of New York. The mortgage is to secure a bond issue. The proceeds of the bond issue are to be used for extensions of the electric plant and service in Sault Ste. Marie. The first section of the plant to be erected will develop from 2,500 to 3,000 horse-power.

TRANSFER OF COLUMBIA WATER-POWER COMPANY—The Columbia Electric Street Railway, Light and Power Company is negotiating for the purchase of the Columbia Water-Power Company. It is proposed to erect an auxiliary steam plant at a cost of $300,000. This plant is to be used in emergencies. The company will supply motive power to the factories, mills and other plants in Columbia, S. C. The merger involves an investment of $2,000,000.

INTERURBAN LINE TO BE BUILT IN CANADA—The London, Chatham & Western Electric Railway will build 113 miles of track connecting London and Windsor, Ont. The legislature has authorized the company to borrow $25,000 per mile of right of way, and has passed an act allowing the company to sell power with the consent of the municipalities interested, and to sell light and heat with the consent by by-law of the people. The road must be in operation within four years.

MERGER PLANNED OF INDEPENDENT TELEPHONE COMPANIES IN NEBRASKA—A company has been organized, and will issue bonds to the amount of more than $500,000, to control all the independent telephone lines in southeast Nebraska, northeast Kansas, northwest Missouri and southwest Iowa. Full details are not at present available, but the combination will include all the independent lines between Omaha and Kansas City as far west as Lincoln, Neb., and as far east as Red Oak, Iowa.

NEW ELECTRIC ROAD IN THE CAROLINAS—The Charleston, Virginia & Ohio Railway has been chartered to build from Charleston, S. C., to Newton, N. C., a distance of 250 miles. The authorized capital is $2,200,000, with $500,000 paid in. The incorporators are W. C. Ervin, H. L. Milner and E. P. Tate, of Morganton, N. C.; W. T. Hunter, Joseph F. Gowan and Robert Regney, of New York. The chief office of the company will be at Morganton, N. C. The road will open up the country from the seaboard to the mountain districts of North Carolina, and on the line are a number of the best-known summer resorts of North Carolina.

COMBINATION OF INDEPENDENT TELEPHONE INTERESTS IN CALIFORNIA—The California Independent Telephone Association has been formed. The combination consists of all the independent telephone companies of southern California. Officers have been elected as follows: president, John L. Van Liew, Los Angeles; first vice-president, D. S. Parker, Pomona; second vice-president, Roscoe Howard, San Diego; secretary, P. T. Spencer, Whittier; treasurer, William L. Frew, Compton. Executive committee: K. C. Wells, Redlands; W. J. Lambert, Riverside; A. L. Orton, Pasadena; P. Kerr Higgins, Los Angeles. Sixteen companies are interested, representing an investment of over $10,000,000. Thirty exchanges, 30,000 instruments, and toll lines extending to 110 towns and cities, are involved.

TELEPHONE AND TELEGRAPH.

READING, PA.—The Conestoga Telephone Company has completed arrangements to build a line from Douglassville to Bramcote.

DES MOINES, IOWA—The Black Hawk & Grant Township Telephone Company has been organized. Fred Schreiber is president.

GADSDEN, ALA.—The Southern Bell Telephone Company expects to complete its new line from Attalla to Altoona within the next two months.

TUNKHANNOCK, PA.—The Bell Telephone Company is extending its lines to Laceyville. The company has completed connection with West Nicholson.

PLAINFIELD, N. J.—The Lebanon Telephone Company is to extend its line from High Bridge to German Valley, taking in all the intervening towns.

ATLANTIC CITY, N. J.—It is said a new system of coast telephones will be installed from Cape May to Sandy Hook for the benefit of the life-saving patrol.

WOODSTOCK, ONTARIO—The Bell Telephone Company will erect a new building in Brantford at a cost of $40,000, and will install a central energy switchboard.

DULUTH, MINN.—The Mesaba Telephone Company will soon make extensive improvements to the service. Two new improved one-hundred drop-boards are to be installed at once in the exchange.

EDWARDSVILLE, ILL.—The Taylorville Home Telephone and Telegraph Company, of Taylorville, is getting ready to install a plant. The capital stock is $50,000, which is owned by local parties.

ADA, MINN.—The old Norman County Telephone Company has been reorganized with the following directors: A. L. Hanson, C. C. Allen, N. T. Moen, Sam Olson, M. A. Brattland, William Bosworth, C. H. Brown.

EMPORIA, KAN.—W. W. Finney, of Neosho Falls, has taken charge of the Emporia telephone exchange, having purchased the stock of the late Frank Brown, of Topeka, who owned the controlling interest.

SEATTLE, WASH.—E. E. Webster, manager of the Independent Telephone Company, has finished preliminary details for a long-distance telephone circuit that is to embrace all the principal points in the Pacific Northwest.

HANNIBAL, MO.—The directors of the Miller Township & Hannibal Telephone Company have elected the following officers: president, George W. Pine; vice-president, H. C. Whaley; secretary and treasurer, L. E. Frazier.

BALTIMORE, MD.—The Union Telephone Company, of Baltimore County, has filed for record a certificate of the increase of its capital stock from 120 shares of the par value of twenty-five dollars each to 400 shares of like value.

PORTLAND, ORE.—More than sixty men are engaged in placing underground conduits on the east side of Portland for the Pacific States Telephone Company. The work will cost about $25,000 and it is expected to have it completed by the latter part of August.

IDA GROVE, IOWA—Manager James E. Moorehead, of the Ida County Telephone Company, announces the early construction of six miles of rural telephone line, and the installation at the same time of about twenty more telephones, which will bring the total

number of instruments connected to the Ida Grove switchboard up to 495, and make a total mileage of lines owned by the local company of 110 miles.

WILKESBARRE, PA.—The Dietrick property on Northampton street has been purchased by the Pennsylvania Telephone Company. It is the intention of the company to erect a modern building. The present site on North Wyoming avenue will be abandoned. The exchange will be modern in all particulars.

UNIONTOWN, PA.—Judge Robert E. Umbel, John M. Core and Robert F. Hopwood, the executive committee of the Tri-State Telephone Company, have effected a deal whereby the Tri-State company becomes the owner of the Monongahela Valley Telephone Company, which is composed mostly of Brownsville capitalists.

SALT LAKE CITY, UTAH—The Bell Telephone Company is making a $20,000 addition to its central station, which will increase the capacity of the office one-third. The installation will be complete inside of thirty days. An exchange is also being installed at Twin Falls, Ida., with one hundred subscribers, and work has been begun in an exchange building at Ogden, where extensive underground improvements will be made.

COHOES, N. Y.—At a meeting of the Cohoes & Waterford Home Telephone Company the following officers were chosen: president, James H. Shine; vice-president, Irving H. Griswold; secretary, Sam Strong; treasurer, George R. Wilsdon; manager, Oliver J. Hawkins. The board of directors is as follows: James H. Shine, John Clute, Fred W. Kavanaugh, Irving H. Griswold, Frederick H. Sudro, Thomas Breslin, George H. Fitts, Paul H. Andrae, Sam B. Rawson, Theodore M. Brush, Howard Hendrickson.

ALBANY, N. Y.—The Home Telephone Company has elected the following officers: president, Howard Hendrickson; vice-president, Irving H. Griswold; treasurer, George C. Lee, Jr.; secretary, Henry J. Prince, Jr.; directors, James Moore, T. Henry Dumary, William H. Keeler, Albert Hessberg, E. B. Toedt, Howard Hendrickson, Eli M. Woodward, George C. Lee, Jr., Richard Stephens, Albany; Samuel B. Rawson, Irving H. Griswold, Theodore M. Brush, Frederick Sundro, W. E. Brooks, E. E. Williams, of Elyria, Ohio.

HARLAN, IOWA—At a meeting of representatives of the Bell and Farmers' Mutual Telephone companies an arrangement was effected, whereby the patrons of the Farmers' lines using the Harlan system may talk over the Bell lines. The Harlan Farmers' central office receives fifteen per cent of the toll charges coming into Harlan, and the Farmers' company at a nominal figure has the use of the Bell telephone poles in the city. The Harlan patrons of the Farmers' company will have Bell transmitters and receivers put in at an annual cost of one dollar.

LANCASTER, PA.—The annual meeting of the stockholders of the Southern Telephone Company was held at Kirkwood. The statements of the officers showed that the company had done a good business during the past year. The company now has direct connection with York County at McCall's Ferry, where messages can be transferred to a large part of that county. The following gentlemen were elected directors for the ensuing year: Cyrus G. Barr, P. C. Swisher and Frank Greenleaf, of Kirkwood; Irwin Cutler, of Furniss; Walter Kent, of Christiana, and T. C. Boyd, of Hensel. The board organized by choosing Irwin Cutler, president; Frank Greenleaf, vice-president; Cyrus G. Barr, secretary, and P. C. Swisher, treasurer.

WILLIAMSON, N. Y.—Announcement is made that the Wayne-Monroe Telephone Company has secured possession of the Kelly exchange at Newark. The Kelly system was established several years ago, and is now the largest system in any one town in the county. It was recently overhauled, and several thousand dollars spent in placing it in excellent condition. The annual election of officers for the ensuing year resulted as follows: directors, John A. Driscoll, of Rochester; J Seldon Brandt, of Ontario; Ledyard S. Cuyler, of Lyons; Albert Yeomans, of Lyons; George R Miles, of Wolcott; George F. Waters, of Pultneyville; James McCrea, of Walworth; William H. Kelly, of Newark, and Judson L. Transue, of Williamson. The board of directors elected John A. Driscoll, general manager and president; Judson L. Transue, secretary and treasurer; J. S. Brandt, Albert Yeomans and Judson L. Transue, executive committee.

ELECTRIC LIGHTING.

WISNER, N. H.—The town has voted to issue $9,000 bonds in order to erect a municipal electric light plant.

LIGONIER, IND.—The city council is asking for bids to light the city with electricity for a period of ten years.

McCOMB, OHIO—The town has purchased the electric light plant for $3,000. Bonds will be issued to pay for same.

OTTOWA, ONT.—The citizens of Ottowa have voted to authorize the city to spend $200,000 in order to purchase the Consumers' Electric Company.

HEMPSTEAD, N. Y.—The Queens Borough Gas and Electric Light Company has been granted a franchise to extend its poles and wires to all parts of the township.

ROCKFORD, ILL.—The Central Heat, Light and Power Company contemplates the erection of a new power-house and options are being secured on land for a site.

CATSKILL, N. Y.—The Catskill village board of trustees has granted the Catskill Illuminating and Power Company an extension of its franchise for thirty years.

ALEXANDRIA, IND.—The Alexandria Electric Light and Power Company will install a new system and add twenty-five arc lamps to the city lighting system, making eighty in all.

HAWLEY, PA.—The plant of the Hawley Electric Light and Power Company was totally destroyed by fire on May 18. The loss is $15,000, of which $10,000 is covered by insurance.

CENTRAL FALLS, R. I.—The city council has secured the option on a site on which to build a municipal electric light plant, when the present contract with the Pawtucket Electric Company expires.

YOUNGSTOWN, OHIO—Plans are being made for an extension of the power-house of the Youngstown Consolidated Gas and Electric Company. The extension is made necessary by reason of the electric company furnishing power for the street railway system.

MONTPELIER, VT.—The Consolidated Light and Power Company, of Montpelier, has been purchased by a syndicate composed of Wilbur F. Davison, A. D. Bennet, George Moore, of Port Huron, Mich., and others. The purchase price is said to have been $200,000.

THOMPSONVILLE, CT.—The Enfield Electric Light and Power Company will extend its lighting system to Hazardville and Scitico. It is estimated that from twenty to twenty-five miles of wire will be used in the work and that from 80 to 100 lamps will be needed.

HALESITE, N. Y.—The plant of the Huntington Light and Power Company is to be enlarged. The boiler capacity is to be doubled. A concrete building, 50 by 30 feet, is to take the place of the frame building now adjoining the power-house. It will contain offices, a laboratory for testing appliances, room for employés and storerooms.

SANDY HILL, N. Y.—The Glens Falls Electric Light Company has been given a fifty-year franchise to operate in Sandy Hill. Incandescent lights are to be supplied at ten cents per kilowatt-hour, and supply current for manufacturing purposes at five cents per kilowatt-hour. The arc lights are to cost $70 per lamp of 2,000 candle-power per year.

NORTH TONOWANDA, N. Y.—Sealed proposals for lighting the city from August 1, 1905, to August 1, 1906, or from August 1, 1905, to August 1, 1908, will be received until 8 P. M., on June 6, 1905. Proposals should be addressed to George J. Smith, city clerk of North Tonowanda, and should be accompanied by a bond to the city of North Tonowanda in the sum of $5,000 as a guarantee of good faith. Plans and specifications are on file in the office of the city clerk.

WILKESBARRE, PA.—The Wilkesbarre Gas and Electric Company will make improvements in its gas and electric plants at a cost of about $400,000. New machinery to be installed in the electric plant consists of an engine, condensing apparatus for all the engines, a new switchboard, and a coal and ash-handling plant. The increase in capacity of the station will be about 750 horse-power. The distribution system is to be changed from direct to alternating current.

ELECTRIC RAILWAYS.

NEENAH, WIS.—There is a report that the two lines, the Neenah-Oshkosh interurban and the Neenah-Appleton interurban, will consolidate their interests.

TRENTON, N. J.—Trenton now has direct trolley communication with Philadelphia, the Philadelphia, Bristol & Trenton Street Railway Company having commenced running its cars to Warren and Hanover streets.

JACKSON, MICH.—Shepherd, Mich., is to have an electric railway—the proposed line from Grand Rapids to Bay City. This line will tap a very rich farming district, most of which is entirely without rail facilities of any kind.

PHILADELPHIA, PA.—The franchise of the Delaware Interurban Railway Company, which purposes to build a line between Wilmington, Del., and Elkton, Md., has been extended one year. The company's work having been delayed.

SOMERSET, PA.—The property of the Meyersdale & Salisbury Street Railway Company, which was taken in execution some time ago at the suit of A. N. Slocum, has been sold to Harvey M. Berkley, cashier of the First National Bank, of Somerset.

CHATTANOOGA, TENN.—S. W. Divine has received official notice from Washington that a license has been granted him by the Secretary of War to build a line through the Chickamauga park and Fort Oglethorpe military reservations.

LEOMINSTER, MASS.—The contract for the building of the new electric street railway of the Worcester Consolidated, from Leominster to Worcester, by way of Sterling and Boylston, has been let and work begun. The contract has been awarded to J. G. White & Company, of New York.

ST. JOSEPH, MICH.—It is learned that Colonel W. W. Bean, former owner of the local street railway, and Charles A. Chapin, of Chicago, will construct the interurban system between Grand Rapids and Chicago, *via* St. Joseph, the proposed system to be the longest in the state of Michigan.

LEXINGTON, KY.—The contract for the construction of the interurban railroad to run between Lexington and Versailles has been awarded to Dolan Brothers. Under the terms of the contract the roadbed is to be completed, the rails laid and the wires stretched and ready for operation by September 15.

LAS VEGAS, N. M.—The Las Vegas electric line, which extends ten miles into the Gallinas cañon, has been sold to W. H. Buddecke, of St. Louis, who represents St. Louis capital. A. H. Duncan, of St. Louis, was the chief owner of the line. New cars have been ordered and the line will be extended and improved.

AKRON, OHIO—The Northern Ohio Traction and Light Company has signed a contract with the Barberton, Wadsworth & Western Railway Company to allow the latter to run its cars into Barberton and Akron over the tracks of the former road. The proposed line is intended to connect with Ashland, and actual work has already been commenced.

ALEXANDRIA, LA.—The Alexandria board of aldermen has granted a franchise for twenty-five years to T. G. Bush, of Mobile, Ala., to construct and operate an electric street car line in the city. The ordinance provides that work shall be commenced within four months, and that not less than three miles of track shall be completed in twelve months.

BLUFFTON, IND.—The Bluffton city council has voted to grant a franchise to the Ft. Wayne, Bluffton & Marion Traction Company for the use of Main and South streets. The interurban company has sixty days in which to accept the franchise and file a bond of $5,000. The company is to have the line from Ft. Wayne into Bluffton in operation by July, 1906.

MOUNT CARMEL, PA.—A charter has been granted to the Catawissa & Numidia Electric Railroad, the proposed line of which will extend from Catawissa to Numidia, where it is proposed to have it connect with another line that will extend from Numidia to Bear Gap. Surveys on the proposed road are to begin at once. It will have direct connection with Bloomsburg.

CHATHAM, ONT.—The formal organization of the Chatham, Wallaceburg & Lake Erie Electric Railway Company has been completed by the election of the following: president, Geo. W. Kipp, Towanda; vice-president, N. H. Stevens, Chatham; secretary, Edwin Bell, Chatham; general manager, W. N. Warburton. Directors: George W. Kipp, N. H. Stevens, D. A. Gordon, J. T. O'Keefe, R. E. Kizer, M. E. Lilley and S. F. Robinson.

YOUNGSTOWN, OHIO—The control of the Youngstown & Southern Railroad Company has passed into the hands of local capitalists, stock to the amount of $900,000 being purchased. The stock of the company represents $1,800,000, and twelve men of Youngstown now control the majority. The work of building the line to East Liverpool will be pushed at once. It will be a third-rail electric system, and contracts have been entered into for the equipment.

MEXICO, MO.—Only about forty miles of the right of way for the Missouri Central Electric Railroad from St. Louis to Kansas City are unsecured, it is said. The part lacking is in the counties of St. Charles, Lafayette and Saline. When the remainder of the right of way is obtained the financing of the authorized $4,000,000 capitalization will be completed and bids asked for the construction work. Bridge engineers have nearly completed plans and specifications for the two Missouri river bridges at St. Charles and Glasgow.

GRAND FORKS, N. D.—S. W. Wheeler, of the Wheeler Land Company, Moorhead, is at work interesting eastern capital in an electric line to run from Crookston to Fargo and Grand Forks. The proposed line would run due west from Crookston, on the south side of the Red Lake river, to a point opposite Fisher. It would there branch, one line running to Fargo and the other to Grand Forks. The line would be ninety miles long—sixty miles from Crookston to Fargo and thirty miles from Crookston to Grand Forks—and would touch a number of prosperous towns in the valley.

LANCASTER, PA.—A meeting of the stockholders of the Lancaster & Eastern Street Railroad was held recently, and it was decided to build the road at once. It will start at Conestoga park and run east down the Williamstown turnpike through the villages of Greenland, Soudersburg, Paradise, Leaman Place, Kinzers, Gap and end at Christiana. The company elected the following directors: Charles B. Keller, J. W. B. Bausman, J. Fred Sener, P. B. Shaw, James P. Marsh, P. E. Slaymaker, John S. Graybill, Jr., H. P. Brackbill, Jonas Eby, E. Herr Esbenshade, Joseph S. Esbenshade, B. Maurice Herr and S. R. Slaymaker. Charles B. Keller was elected president of the company, S. R. Slaymaker, vice-president, and John S. Graybill, secretary and treasurer.

ASBURY PARK, N. J.—The Seacoast Traction Company, which operates a trolley road from Belmar to Spring Lake Beach, recently secured a ninety-nine-years' franchise for an extension of its route through Spring Lake to Sea Girt, passing through Villa Park, and with the terminal adjacent to the state encampment grounds at Sea Girt. Through cars are now run between Asbury Park and Spring Lake, passing along the westerly boundary of Ocean Grove and through Bradley Beach, Avon-by-the-Sea, Belmar and Como. It is planned to have the Sea Girt extension completed in time for use this summer. The Monmouth County Electric Company is also arranging for the extension of its tracks to Oceanic. This company now owns and operates the road between Red Bank and Long Branch, connecting at the latter place with the Asbury Park cars. Still another road contemplated will run from Point Pleasant to Trenton, by way of Lakewood and Freehold.

MUSKEGON, MICH.—The annual meeting of the stockholders of the Muskegon Traction and Lighting Company was held recently. Out of 6,600 shares of common and preferred stock 5,500 shares were represented in person or by proxy. The following officers were elected: president, F. A. Nims; vice-president, Liddon Flick; secretary, Theodore S. Barber; treasurer, D. D. Erwin; directors, John N. Conyngham, E. F. Payne, Liddon Flick and Theodore S. Barber, of Wilkesbarre; F. A. Nims, Louis Kanitz and Thomas Munroe, of Muskegon. The report of the president showed that the net earnings of the company for the year to March 1 were $60,716.78, an increase of $5,278.73 over the previous year. As the bond interest of the company is $30,000, the company has earned more than twice the interest charges. The earnings for the past two months show an increase of eight per cent, and the outlook for the present year's business is exceedingly bright. Twenty-five thousand dollars was spent during the past year on betterments.

NEW INCORPORATIONS.

PLEASANTVILLE, NEB.—Union Telephone Company. $5,000.

FREDERICTON, N. B.—Provincial Telephone Company. $9,000.

LINCOLN, NEB.—Falls City Telephone Company. Increased to $50,000.

WATERFORD, N. Y.—The Waterford Electric Light, Heat and Power Company. Increased to $500,000.

SPRINGFIELD, ILL.—Mount Pleasant Telephone Company. $10,000. Incorporators: S. O. Stout, U. G. Ragsdale, James F. Dick.

PORTLAND, ORE.—St. Johns Water Works and Lighting Company. $50,000. Incorporators: J. L. Hartman, H. L. Powers and E. L. Thompson.

ALBANY, N. Y.—The Lower Niagara River Power and Water Supply Company, of Lewiston, Niagara County. Increased from $700 to $2,000,000.

ST. BERNICE, IND.—The Citizens' Mutual Telephone Company. $400. Directors: J. T. Newton, J. P. Hartsook, A. M. Reed, H. M. Nolan and V. P. Houston.

KEENE, N. H.—Citizens' Electric Company. $35,000. Incorporators: Robert E. Faulkner, G. Fred Little, L. M. Willard, Elisha F. Lane and Daniel R. Cole.

SALT LAKE CITY, UTAH—The Perry Electric Light and Power Company. $20,000. Officers: president, V. T. Davis; vice-president, John W. Francis; secretary and treasurer, James Young.

ST. PAUL, MINN.—The Walker Telephone Company. $50,000. Incorporators: E. I. P. Staede, Mankato; Charles Kinkele, C. E. Griffith, George E. Crow and Daniel De Lury, Walker.

OAKLAND, CAL.—Traction Transportation Company. $75,000. Directors: W. C. Reveal, of Berkeley; Jas. W. Blaine, W. S. Peters and W. H. Chickering, of Oakland, and H. C. Brougher, of Tonopah.

AUSTIN, TEX.—Gainesville Electric Railway and Light Company, of Gainesville. $50,000. Incorporators: E. J. O'Bierue, of Memphis, Tenn.; C. A. Zilker, of San Antonio; W. L. Greenhill, of Gainesville, and W. H. O'Bierue, of Gainesville.

ALBANY, N. Y.—The Niagara Power and Transmission Company, of Niagara County. To generate, sell and transmit electric power for all purposes. $5,000,000. Directors: Edward B. Bruce, Allan C. Rearick, Edward E. Stowell, Frank H. Cole, of New York, and John J. Daily, of Brooklyn.

INDIANAPOLIS, IND.—Laycock Power-House Company. $250,000. Officers and directors: president, T. B. Laycock; vice-president, Charles E. Coffin; second vice-president, I. N. Richie; treasurer, Charles E. Holloway; secretary, James F. Lindley; additional directors, W. H. Laycock, Clarence A. Kenyon, John H. Lytle and Irvin Conoway.

ALBANY, N. Y.—The Killawog Telephone Company. To construct a telephone line connecting the towns of Lisle and Triangle, Broome County, and Marathon, Willett, Lapeer, Harford, Virgil, Freetown, Cortlandville, Hoover, Preble, Cincinnatus and Solon, Cortland County. $18,000. Directors: Charles G. Tarble, Irving R. Hitt, Marvin Muckey, of Killawog; Albert C. Baker, A. C. Adams and Charles A. Brooks, of Marathon, and W. S. Dickson, N. L. Shevalier and Joseph Shevalier, of Messengerville.

ALBANY, N. Y.—Oswego River Power Transmission Company, of Syracuse; to supply gas and electricity for power, light and heat in the counties of Onondaga and Oswego in particular, with the privilege of operating all through the state; $20,000; directors: Simon B. Storer, Louis W. Emerich and George W. Pulver, of Syracuse. Aqua Light and Power Company, of New York; $100,000; directors: Daniel H. Foley, of Brooklyn; Joseph M. Linden, of Wood Ridge, N. J.; James Simmons, of New York. Nassau & Suffolk Lighting Company, of Hempstead, Nassau County; to operate in Nassau and Suffolk counties; $200,000; directors: Samuel M. Havens, Dana T. Ackerly, George J. Corbett and F. C. Hauser, of New York, and James G. Stevenson, of Brooklyn. Over and Power Company; $20,000; directors: Simon B. Storer and George W. Pulver, of Syracuse, and Louis W. Emerich, of Fulton.

EDUCATIONAL NOTES.

UNIVERSITY OF MISSOURI—The University of Missouri, Columbia, Mo., has issued a bulletin describing the courses offered during the summer session, which will last from June 10 to August 10.

PURDUE UNIVERSITY—The following programme has been announced for commencement week at Purdue University, Lafayette, Ind.: Sunday, June 4, in Fowler Hall, baccalaureate address by Herbert Lockwood Willett, Ph. D., University of Chicago, 3 P. M.; vesper song service, 5 P. M. Monday, June 5, annual exhibit of the art department in the art studios, continuing throughout Tuesday; all departments and buildings open for inspection by visitors; ball games on Stuart field to be arranged between alumni, varsity, faculty and seniors; musical recitals in Fowler Hall by members of University, 4 P. M.; class and fraternity reunions and social functions in the evening. Tuesday, June 6, class-day exercises of the senior class during the morning, Fowler Hall and campus; ball game between Purdue and Indiana University, Stuart field, 3 P. M.; official reception in honor of alumni, graduates and guests, Agricultural Building, 8 to 11 P. M. Wednesday, June 7, graduation exercises, Fowler Hall, 9.30 A. M.; abstracts from these by members of the graduating class; address by Henry Churchill King, D. D., president of Oberlin College; conferring of degrees.

PERSONAL MENTION.

MR. D. H. ROBINSON has resigned as superintendent of the Indianapolis & Eastern Electric Railway, and has accepted a similar position with the Indianapolis & Western Electric Railway, which is now building a line between Indianapolis and Terre Haute, Ind.

MR. D. PERCY HARTZELL, of Frostburg, Md., has been elected secretary and treasurer of the Cumberland & Westernport Electric Railway. Mr. Hartzell held a position with the Cumberland & Pennsylvania Railroad, and succeeds Mr. W. H. Roberts, Jr., who has resigned.

MR. WARREN B. REED has recently returned from Nicaragua, where he installed and managed an electric light plant at the capital city of Managua. He has opened offices at 1011 Hibernia Bank Building, New Orleans, La., where he will carry on a consulting engineering practice.

MR. WILLIAM W. DONALDSON, electrical engineer of the Gould Storage Battery Company, has resigned and will spend the summer in the South resting. Mr. Donaldson has been a very hard worker, and his unremitting application has undermined his health. He has been ill for some time, and he will now reside at St. Denis, Baltimore, Md., where he will rest and recuperate.

MR. HOMER E. NIESZ, editor of the "Question Box" for the twenty-eighth convention of the National Electric Light Association, which will be held at Denver-Colorado Springs, Col., June 6-11, was a visitor to New York last week. Mr. Niesz is superintending the closing of the "Question Box," which will be bigger and better than ever. Few realize the great amount of work involved in making complete the most important department of the convention programme, and the association is to be congratulated upon having had the service of Mr. Niesz as editor.

MR. H. J. SLIFER has accepted a position with J. G. White & Company, Incorporated, 49 Exchange place, New York, as steam railway expert. Mr. Slifer was born in 1859, and graduated as a mining engineer from the Polytechnic College of Pennsylvania in 1880. From 1880 to 1882 he was with the Mexican National Railway and was engineer in charge of construction when he left the company. In 1882 he was made assistant engineer in charge of maintenance on the Philadelphia division of the Pennsylvania Railroad. His work included the replacing of a number of bridges and the moving of several bridges bodily to new locations. From 1891 to 1893 Mr. Slifer filled the position of assistant chief engineer of the Milwaukee, Lake Shore & Western Railroad, and upon its being merged with the Chicago & Northwestern he was made engineer of the Ashland division. He held this position until 1897, and during this time designed and constructed a large amount of dockage. From 1897 to 1899 Mr. Slifer was in charge of the construction of double track in Iowa for the Chicago & Northwestern Railroad. In 1899 he was made superintendent of the Iowa division of the Chicago & Northwestern Railroad, the operating, maintenance and motive power departments coming under his direction. In 1902 he

resigned to accept the position of general superintendent of the Chicago, Rock Island & Pacific Railroad in charge of operation, motive power and maintenance between Chicago and Denver. Mr. Slifer, as steam railway expert of J. G. White & Company, will be in responsible charge of matters relating to its steam railway undertakings.

ENGINEERING SOCIETIES.

PENNSYLVANIA STATE COLLEGE—The Electrical Society of the Pennsylvania State College met on Wednesday evening, May 17. The Institute papers on polyphase metering and the oscillograph were read and discussed. The final meeting for the school year was held on May 24.

TORONTO BRANCH OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—The twentieth regular meeting of the Toronto branch of the American Institute of Electrical Engineers was held on Friday evening, May 12. The subject for discussion was "Incandescent Lamps." Mr. A. B. Lambe introduced the discussion with an address entitled "Some Notes on Incandescent Lamps." The paper by J. D. Nies, entitled "Some Notes on Polyphase Metering," was also discussed.

LEGAL NOTES.

EXHAUSTING INCANDESCENT LAMPS—On May 17 District Judge Joseph Cross overruled the demurrer of the Germania Electric Lamp Company in the suit of the General Electric Company in the United States Circuit Court for the District of New Jersey. The patent involved in the suit was granted April 1, 1903, No. 726,293, upon the invention of John W. Howell, for a process of exhausting incandescent electric lamps, covering the method well known to incandescent lamp manufacturers as the "chemical exhaust," and owned by the General Electric Company. The justice held that a demurrer to a patent can be sustained only when the question of invention is free from doubt. There must be in the mind of the court an absolute conviction of the lack of invention; and if there is any doubt on this point, the case must be decided adversely to the demurrant. The court is not convinced that the patent does not disclose invention, and the demurrer is overruled.

IN A DECISION HANDED DOWN BY JUDGE RAY, in the Circuit Court of the United States, Southern District of New York, in the suit of Otis A. Mygatt *vs.* Edmund L. Zalinski and the Illuminating Engineering Company, for alleged infringement of a design patent on prismatic reflectors, manufactured by the Holophane Glass Company, the validity of the Mygatt patent was fully sustained, and the reflectors manufactured by the Illuminating Engineering Company held to be an infringement. A permanent injunction and accounting were ordered. The trial of this suit brought out some novel features in patent law, it being the first case on record where the peculiar appearance arising from the use of transparent glass has come into question. The patent on which suit was brought was design No. 32,685, and covered the well-known prismatic reflector which has been manufactured and sold by the Holophane Glass Company for the past five years. The infringing reflector was of the same general characteristics but with a slight modification, which had also been made the subject of a design patent. It was contended by Zalinski that the Mygatt patent was invalid, and also that his reflector was sufficiently different not to infringe. Both contentions, however, were denied by the court. In his decision, Judge Ray says, "in open court the complainant's reflectors, made according to the patent, were produced and placed in the position designated. It was clearly apparent to the court that the reflectors fill the bill, are all that is claimed. The evidence fully sustains the claim of the patent. The defendants are making and selling substantially what the complainant is making and selling or is authorized by his patent to make and sell. True, in some, if not all, the angle is changed; the edge is curved or beaded and in some there are other slight changes, but these changes are evidently made to be used in justifying the infringement if possible. The defendants' shades or reflectors are bald appropriations of the complainant's patent. Slight changes are made which add nothing to the ornamentation but rather detract therefrom. These, however, enable the defendants to say, 'our shade or reflector is different from yours; therefore we do not infringe.' . . . Clearly the patent is not void for want of invention. It is not claimed that 'the patent is generic as to form of configuration of the shade-body —embracing all frustums of cones.' They (the defendants) say, 'we may use the frustum of the cone shape, we may use a circular collar with an opening, we may use a smooth inside face, we may use the prismatic ribs; we may have them long or short as we elect; therefore we may use them in the combination indicated by the complainant's patent.' This can not be so if any design patent is to be held valid. . . . The court is of the opinion that the patent is valid and that defendants infringed. There will be a decree for an injunction and an accounting."

ELECTRICAL SECURITIES.

Professional sentiment regarding the present condition of the stock market is decidedly mixed. During the past week there was almost every conceivable variety of speculative agitation. Throughout one session there would be extreme buoyancy, followed by a decided reaction, and then again by considerable apathy. While it is held that the market is intrinsically sound, there are so many uncertainties in the situation that it is not presumed that there will be any early resumption of active speculation or any immediate advance in prices. It is quite unlikely, however, that there will be any further retrogression, as reports from almost every quarter indicate that there has been no abatement, and that there is no abatement in sight, of the prosperity which has been pretty general for the last year.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MAY 20.

New York:	*Closing.*
Brooklyn Rapid Transit	60¼
Consolidated Gas	186
General Electric	170
Interborough Rapid Transit	201
Kings County Electric	200
Manhattan Elevated	162
Metropolitan Street Railway	115¼
New York & New Jersey Telephone	172
Westinghouse Manufacturing Company	188

Boston:	*Closing.*
American Telephone and Telegraph	139
Edison Electric Illuminating	246½
Massachusetts Electric	60
New England Telephone	137
Western Telephone and Telegraph preferred	98

Philadelphia:	*Closing.*
Electric Company of America	11¾
Electric Storage Battery common	79
Electric Storage Battery preferred	79
Philadelphia Electric	11⅝
Philadelphia Rapid Transit	32¼
United Gas Improvement	113½

The directors of the Philadelphia Electric Company have declared the regular semi-annual dividend of 2½ per cent, payable June 15 to stock of record May 24.

Chicago:	*Closing.*
Chicago Telephone	142
Chicago Edison Light	155
Metropolitan Elevated preferred	61½
National Carbon common	60
National Carbon preferred	116
Union Traction common	7¼
Union Traction preferred	37

The Chicago Union Traction report from March 1 to May 9 shows receipts and disbursements for each period equal. For March receipts and disbursements were equal at $1,239,642; for April at $1,247,021, and for nine days of May at $704,568. The company does not appear to be making any money. Cash on hand May 9 is set at $263,444 against $383,157 on March 1. The report shows that the receivers were each paid $1,500 per month.

INDUSTRIAL ITEMS.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., will be pleased to send its new index of publications. This is designated as bulletin No. 90, and is dated April, 1905.

THE WESTBURY LAMP COMPANY, 49 Hamilton street, Newark, N. J., is calling attention to its line of miniature lamps. These are of all forms and range in size from three-quarters to sixteen candle-power. They are made for voltages ranging from 2 to 130.

THE STERLING ELECTRICAL MANUFACTURING COMPANY, Warren, Ohio, manufacturer of the "Sterling Special" incandescent lamp, announces a reduction in price of frosted lamps from existing schedules, after May 19. The new schedule of prices may be secured upon application.

PARSELL & WEED, 129-131 West Thirty-first street, New York city, have issued bulletin No. 9051, describing Brocksmith dynamo castings and complete experimental outfits. The outfits comprise dynamos, motors, dynamotors, motor-generators, single-phase rectifiers, alternating-current generators, etc.

THE ASSOCIATION OF LICENSED MANUFACTURERS OF INCANDESCENT LAMPS, through its advertising committee, has issued a folder describing the advertising of licensed lamps which is now being done. The pamphlet consists of twenty pages, and contains a large number of advertising devices and labels.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued bulletins Nos. 4408 and 4409, describing, respectively, 125, 250 and 600-volt continuous-current, two-wire switchboard panels, and electrically driven turbine house pumps. The company has also issued publication No. 9138, entitled "Automatic Railway Block Signals."

THE GENERAL STORAGE BATTERY COMPANY, 42 Broadway, New York city, has issued catalogue A, descriptive of "Bijur" storage batteries of the "high-duty" type for stationary service. This catalogue is elaborately illustrated, and the text is sufficient to give a very good understanding of the electrical and mechanical features of the apparatus

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., has broken ground for a two-story addition to its plant, which will have an area of 50 by 150 feet. The company is also erecting two very large porcelain kilns, in addition to its present equipment. Enlargements such as these have been made annually practically since the erection of the pottery, and they are becoming more extensive every year.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, was prominently represented at the recent International Railway Congress. The company's representatives were T. F. Manville, president; J. E. Meek, in charge of the company's exhibit; L. B. Melville, and James Younglove, manager of the company's Chicago branch. The company had an interesting display of asbestos and magnesia products and electrical supplies.

THE HOLOPHANE GLASS COMPANY, New York city, has recently secured an important decision in a suit for alleged infringement of a design patent on prismatic reflectors. The company owns numerous design patents covering all the forms and shapes of reflectors which are constructed on the prismatic principle. It is its intention to bring other suits immediately against all manufacturers and dealers who are making or selling prismatic shades or reflectors that infringe these patents.

THE STANDARD VITRIFIED CONDUIT COMPANY, 39-41 Cortlandt street, New York city, states that it is supplying a large portion of the Bell telephone interests, the tunnels under the North and East rivers, New York, the underground rapid transit system of New York, the New York Central and Pennsylvania improvements, the Philadelphia Electric Company, the city of Baltimore, Norfolk, Va., and the forts of New York harbor with orders of vitrified conduit aggregating upward of 10,000,000 feet.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Ct., is calling attention to a very simple form of battery switch which it is placing on the market with great success. The end clips are made with spring fingers which press firmly against the blade, and, when changing from battery to magneto, a single slight movement throws the blade from one clip to the other, the change being made instantly. The base is of slate, two by four inches. All metal parts are heavy gauge copper.

FRANK B. COOK, Chicago, Ill., is advertising his protective devices of various types in a pamphlet in the form of an insurance policy. The instruments described on the interior pages of the policy are the type L protector, the Cook No. 8 self-soldering protector, the type SW pole cable terminal, the type JB junction box, and the pole terminals of the following types: A, SM, TM, H, W and M-2. Other articles described are the type 12-A subscribers' station protector, Cook's universal guy clamps, Cook's U-bolt clip, and the type 00 multiple-contact test connector.

DODGE & DAY, Philadelphia, Pa., as engineers and architects, have been commissioned by William Knabe & Company, Baltimore, Md., to take entire charge of extensive improvements to their plant. The operation includes a new five-story building 225 feet by 50 feet; new dry kiln and wood mill, as well as numerous changes to the present buildings. There will also be a new power plant, which will involve the purchase of a new engine and generator. Motors will be installed, and considerable electrical work done, as it is the intention to operate the plant electrically throughout.

THE CHICAGO FUSE WIRE AND MANUFACTURING COMPANY, Chicago, Ill., will be pleased to mail its new bulletin No. 16, descriptive of "Union" enclosed fuses and blocks. This system of fuses has been perfected after several years of experimental work, and now includes the styles known as the "National Code Standard" and, in addition, fuses in sizes to fit other styles of blocks in common use, as well as a large variety of switchboard fuses of all sizes. "Union" code blocks are made from the highest grade of electrical porcelain with mountings of heavy brass and with phosphor-bronze springs. Extra fittings suitable for panel and switchboard work are also furnished for the fuses.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., has issued a Brownie bulletin descriptive of common battery desk telephones. This bulletin is unique in its get-up, and will doubtless attract considerable attention. In addition to the allegorical pictures shown, there is a good technical description of the apparatus. A feature of the new desk-stand set is a metal desk-set box. The box is shallow, so that it may be mounted in any convenient place about a desk without being in the way. Standard parts are mounted in an iron case finished in black enamel. There are enclosing leads front and back which, when removed, expose the ringer, condenser and connecting racks. The new desk-stand set is furnished complete with cords and one of these metal desk-set boxes. Full information will be furnished upon application.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing considerable literature on fan motors, both direct and alternating current. The company, as general western agent for Diehl direct-current fan motors, carries in Chicago a large assortment of both desk and ceiling fans. In addition to this the company states that it is prepared to furnish Central Electric and Westinghouse fan motors, and that on all three lines the prices are attractive. The company will furnish catalogues and quotations, and will appreciate all enquiries on this subject. It has recovered a number of catalogues from the ruins of its building which was burned in February. These have been rebound and are doing service until new ones can be prepared. In the front of the book are photographs of the ruins of the old building, and of the company's new place of business 207-211 East Jackson Boulevard

THE WESCO SUPPLY COMPANY, St. Louis, Mo., is distributing a catalogue of electric railway and mining appliances. The company states that this is the most comprehensive catalogue on the subject which has ever been printed. The book contains about 500 pages, and is carefully compiled, edited and thoroughly indexed as to subjects, code words and catalogue numbers. The various sections treat of track equipment, rail bonds, bonding sleeves, pole brackets and fittings, trolley wire, anchors, guard wire insulators, trolley clamps, section insulators, cross-overs and switches, construction materials and supplies, motor and car supplies, station and mine devices and construction, linemen's and bonding tools. The last section contains a collection of data and information which the purchasing agent and engineer will find convenient. It consists of tables of sizes and weights of materials, and other information of a similar nature.